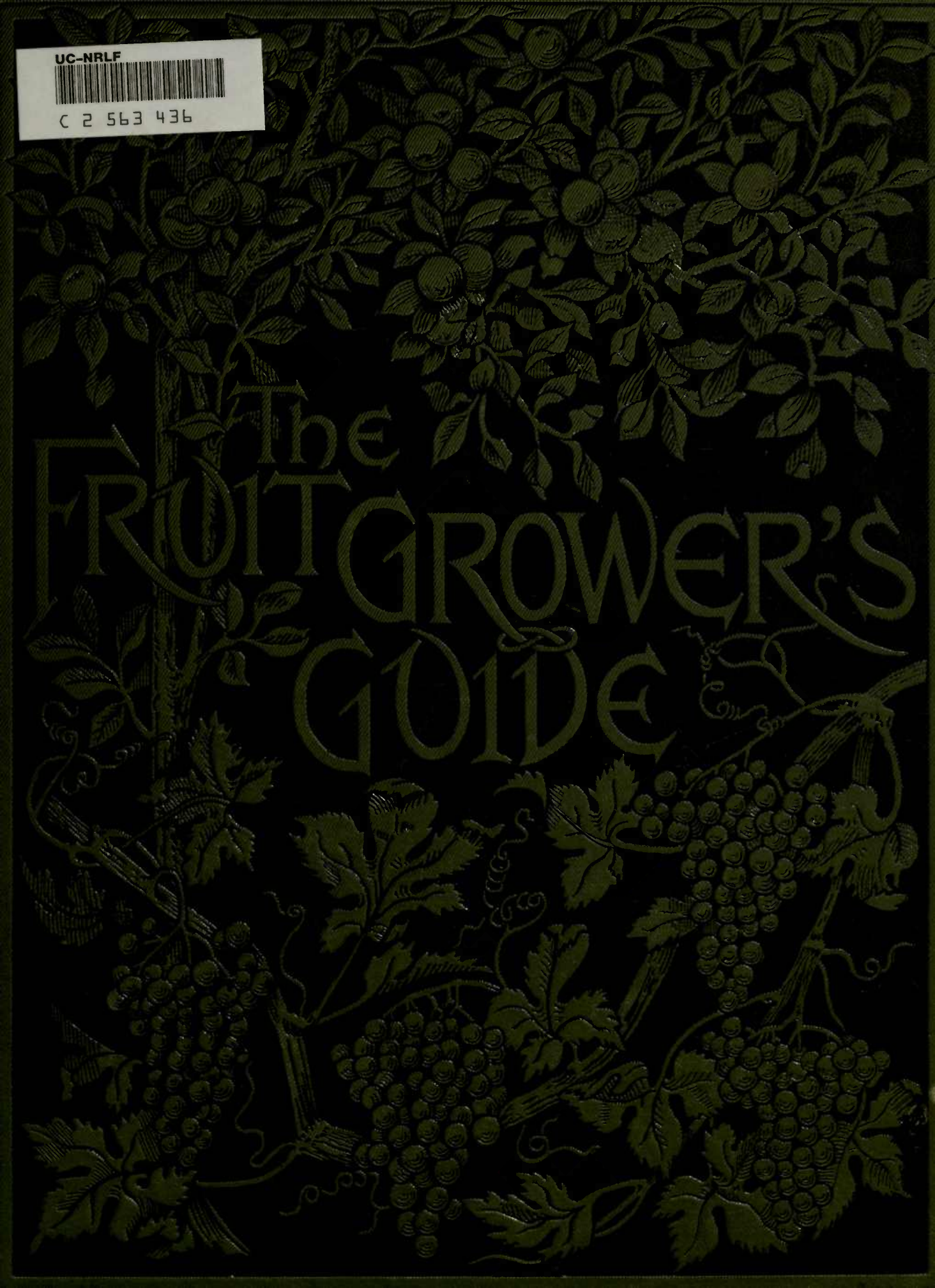


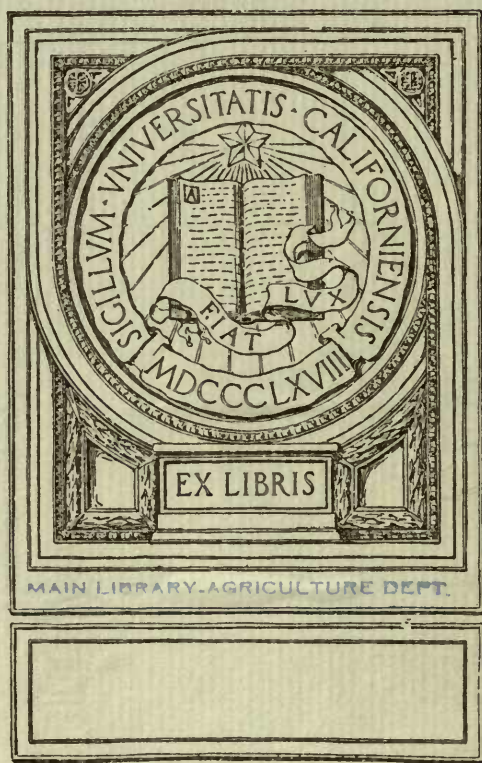
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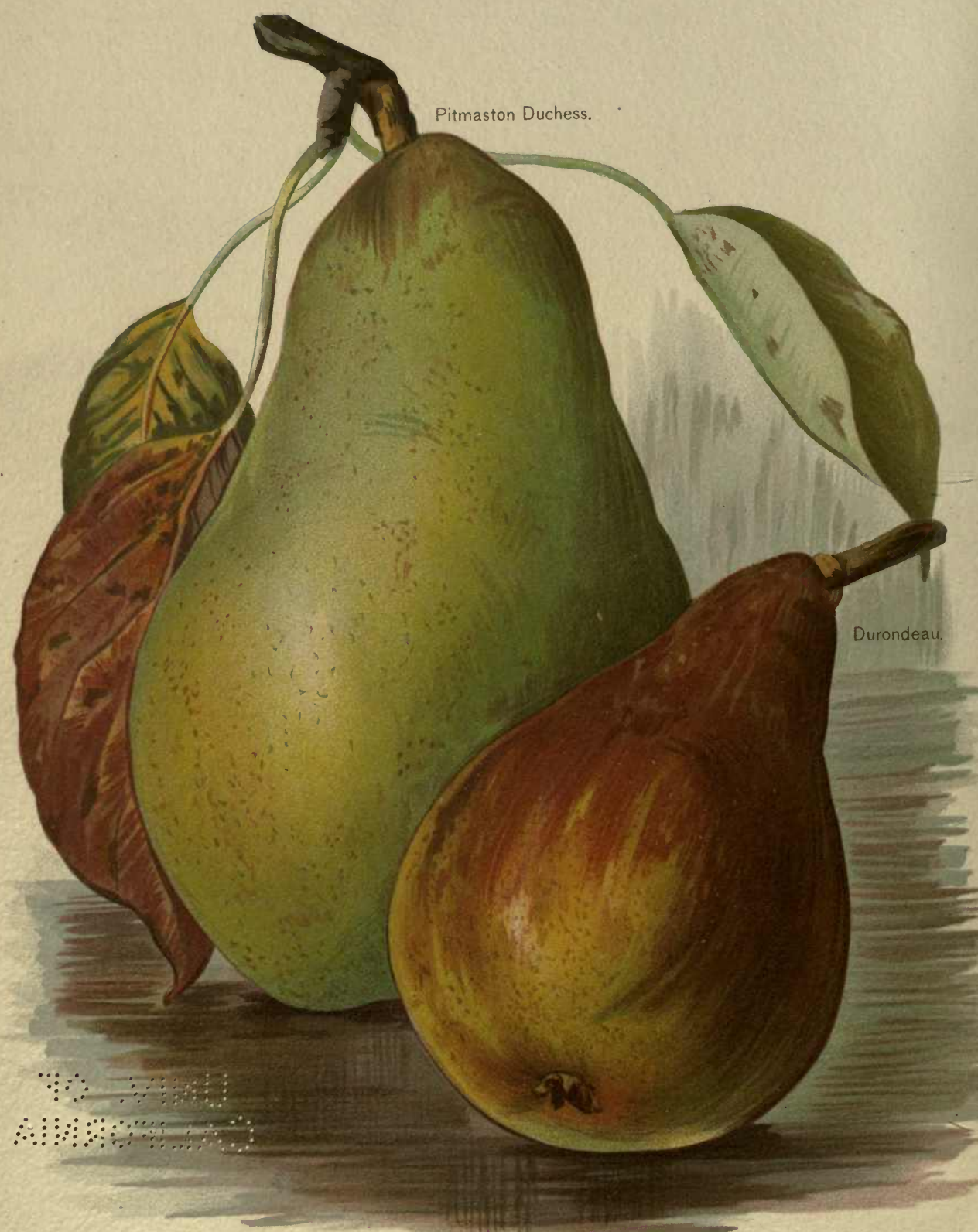
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The FRUIT GROWER'S GUIDE





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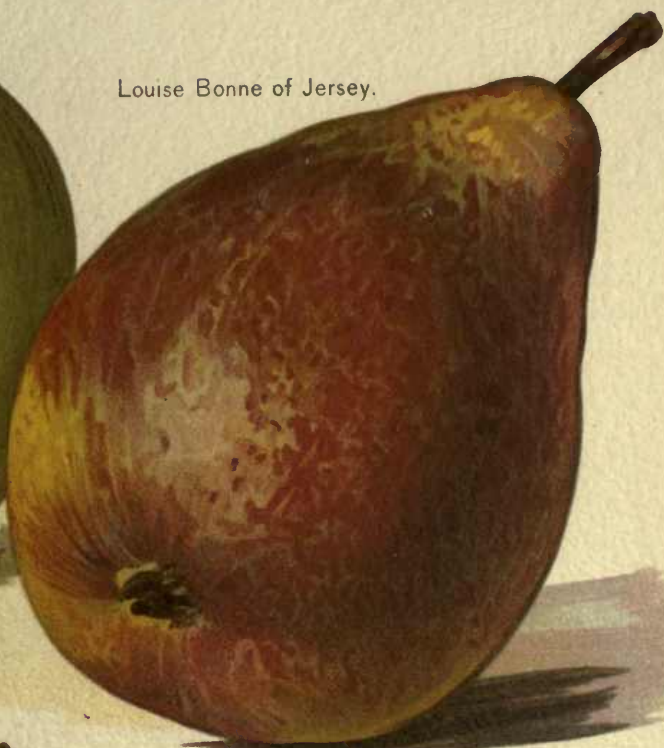
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FRUIT GROWER'S GUIDE

BY

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WITH ILLUSTRATIONS BY MISS MAY RIVERS

AND

NUMEROUS ILLUSTRATIVE DIAGRAMS BY WORTHINGTON G. SMITH AND GEORGE SHAYLER

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The shrub fruits the most freely when allowed to assume its natural habit, limiting the pruning to thinning the growths for preventing crowding and to shortening irregularities, as after close cutting back some time elapses before the fruiting habit is acquired again.

The *Eugenia* succeeds well either grown in pots, or planted in well-drained borders. The pots should be clean and well drained, and, as before stated, the soil firm. Fruiting specimens may be grown in 12 to 15-inch pots. When crowded with roots, surface dress with old cow manure, and support with clear soot-water; keep the soil moist at all times, yet avoid overwatering. Syringe moderately in summer, except when the plants are flowering, and avoid wetting the fruit after it commences ripening. Afford all the light possible, and free ventilation. The winter temperature should be 40° to 45° artificially; at and above 50° give abundance of air. The plant is well worth growing in light conservatories and green-houses for its flowers and fruits. The latter when ripe emit an agreeable perfume, pervading the whole house. A specimen upwards of 20 feet high grown with camellias in the border of a conservatory near London was highly cherished and produced ripe fruit in great abundance over a long period. *Eugenia Ugni* is only grown by amateurs or connoisseurs, the fruit having no commercial value.

FIGS.

THE Fig is the oldest of historical trees, and is frequently mentioned in the Bible; it abounded in Judea (Deuteronomy viii. 8); its shade was highly valued (1 Kings iv. 25); the putting forth of the fig tree was one of the earliest indications of summer (Song of Solomon ii. 13); and a failure of its fruit was a great calamity (Jeremiah v. 17). Xerxes, it is said, was tempted by the exquisite flavour of the figs of Athens to undertake the conquest of Attica (Greece) in 480 B.C. Pliny has recorded that the Romans possessed a number of varieties prior to the Christian era, and they, according to tradition, introduced the fig into Britain, cultivating it in the Isle of Thanet. Cardinal Pole imported fig trees from Italy in 1525, and planted them against the Archbishop's palace at Lambeth. Two of these trees covered a wall area 50 feet in height and 40 feet in breadth in 1730. In the severe winter of 1813-14 these trees were cut down to the ground, but growing again from the roots they were in a promising condition in 1817, and were destroyed in 1836. Archbishop Cranmer is stated to have brought fig trees from Italy, and planted them in the Manor House Gardens at Mitcham (about 1533), these growing to a great size, with stems nearly 1 foot in diameter. They were destroyed in 1790. In the time of James I. a fine old fig tree existed in the Dean of Winchester's garden. Dr. Pocock, in 1648, introduced a fig tree from Aleppo, and placed it in the garden of the Regius Professor of Hebrew, at Christ Church, Oxford. This tree was healthy, 21 feet high, and its stem 3 feet in circumference in 1806; but in 1809 a fire so damaged the trunk as to cause its decay and removal. Fresh growths, however, sprang from the roots and these were 21 feet high in the centre of the tree in 1819. Fruits from this tree, a white variety, took first prizes at the London and Oxford Horticultural Societies' shows in 1819 and 1833.

Although there is no authentic record of the Romans having brought the fig to this country, there is proof that it was introduced at an early date, for figs were largely cultivated in the thirteenth century, Matthew Paris mentioning this as one of the fruits destroyed by the inclement summer of 1257. Tarring, in Sussex, was given by

King Ethelstan "to the church of Christ in Canterbury," about 943, and in Domesday Book it is mentioned as part of the archbishop's possessions. In 1277, the tenant not paying his rent, a record states the prices at which some of the produce might be claimed: "a good goose 1d., two good hens 1d., five score of eggs 1d." Thomas Becket became archbishop, and, it is believed, planted figs brought from Italy in the manor grounds of Tarring. The grand old White Marseilles tree in the fig garden there is believed to be a descendant of one of those planted by Archbishop Becket. The circumference of its stem just above the ground was 9 feet in 1872, the stem separating into four main limbs, each nearly 3 feet in circumference, and the branches covered a circle 40 feet in diameter. The tree was severely injured by lightning in 1885. The fig garden at Tarring is three-quarters of an acre in extent, contains about 100 trees, chiefly Brown Turkey, and these bear abundantly and unfailingly. They rarely ripen a second crop, but did so in 1869. The crop ripens in August, September, and October, and some of the trees bear twenty dozen figs. The trees are allowed to grow naturally, and form a dense grove, nothing flourishing beneath them. They have little pruning, the knife being only employed occasionally to thin the branches.

On the seaboard between Arundel and Worthing fig trees grown as standards are numerous, healthy and productive. The soil is a rich alluvial loam, in many places four feet deep before reaching the subsoil, which is more clayey than the surface soil. Mr. Maher, who was gardener at Arundel Castle in 1818, mentions seven standard trees in the garden there, six being of the Violette or Bordeaux variety, and the seventh the White Marseilles. The last named was the largest, its stem being 6 feet 9 inches in circumference at 2 feet above the surface, and the branches covering a circle 30 feet in diameter. This variety is asserted to have been brought by the Phœnicians to Marseilles about 600 years B.C.

The fig (*Ficus carica*) is a native of the Mediterranean region, Syria, Eastern Persia, to Afghanistan, and its cultivation is now general in all the warm, temperate and sub-tropical regions of the earth. Dr. Bretschneider stated that it was cultivated in China as early as the latter part of the fourteenth century. It may be as well to state, for the benefit of the uninitiated, that the flowers of the fig tree are never apparent to the eye, but are contained in those fruit-like bodies produced in the axils of the leaves, and it is not until one of these is opened that the flowers are visible. What is therefore termed the fruit is merely the receptacle become fleshy, and having assumed

the form of a hollow body, bearing on its interior wall the flowers or fruit of the fig.

The fig tree, in all its parts, abounds in a viscid, milky juice, and this is found even in the fruit before it arrives at maturity; this juice is acrid, and is used on the Continent to destroy warts; in Pliny's time it was thought to cure the bites of venomous animals and mad dogs. The fleshy part of the fig is very agreeable, and many varieties are cultivated in this country. Figs are dried either in the sun or in stoves, and are known under different names, according to the places where they are produced; they form the great part of the food of certain peoples of Africa, and even the peasantry of some parts of Italy and Spain; with us they are only eaten as a dessert.

Thoroughly ripened, well-grown figs, fresh from the tree, are amongst the richest and most luscious of fruits, esteemed at dessert and as wholesome food. A prejudice, however, exists among some people, who, tasting the fruit for the first time, consider it sickly, but a person once eating a fig at its best—not gathered till it droops, the skin slightly cracked, and the juice exuded, standing on the surface like dewdrops and a large tear in the eye—quickly acquires a relish for ripe figs.

VARIETIES.

Figs are very numerous: sixty-six varieties were proved at Chiswick in 1890, a report on "Figs and their Culture," by Mr. A. F. Barron, being given in the *Journal of the Royal Horticultural Society*, vol. xiii., page 122. In Dr. Hogg's *Fruit Manual*, fifth edition, seventy varieties are enumerated and scientifically described. Figs are divided by Dr. Hogg into two classes—1, fruit round, roundish, or turbinate, with three divisions; 2, fruit long, pyriform, or obovate, with four divisions. But for cultural purposes we have divided them into three classes.

I.—FRUIT BLACK OR PURPLE.

BLACK BOURJASSOTTE.—Fruit medium, roundish oblate; neck short, obscurely ribbed; skin black, covered with a thick blue bloom, slightly cracked when ripe; flesh deep red, thick, syrupy, delicious; tree a free bearer.

BLACK GENOA.—Fruit large, oblong, broad at the apex, slender towards the stalk; skin dark purple, covered with a thick blue bloom; flesh yellowish under the skin, but red towards the interior, juicy, and well flavoured; tree hardy, and a free bearer. This variety is the large black fig so commonly grown in the South of France, and known under the synonyms, Nigra, Negro d'Espagne, Noire de Languedoc.

BLACK ISCHIA (Early Forcing).—Fruit medium, turbinate, flat on top; skin deep purple; flesh deep red, sweet, luscious; tree hardy, early and prolific; useful for pot culture.

BLACK PROVENCE (Black Marseilles, Reculver).—Fruit small, oblong; skin dark purple; flesh red, juicy, and richly flavoured; tree very prolific; good for pot culture.

BORDEAUX (Violette de Bordeaux).—Fruit below medium size, long, pyriform, ribbed; skin black, covered with blue bloom, frugose, shrivelling when dead ripe; flesh pale copper, juicy, and well flavoured; very prolific, and keeps well when ripe.

GOURAUD NOIR.—Fruit medium, oblong ; skin dark purple ; flesh red, sweet, rich and deliciously flavoured.

LARGE BLACK DOURO.—Fruit very large, long, pyriform ; skin dark purple ; flesh dull red, juicy and good ; midseason ; tree a good cropper.

NEGRO LARGO.—Fruit long, pyriform, large ; skin black, ribbed ; flesh pale, red, juicy, thick and, when well

ripened, rich ; good fruits weigh about 4 ounces ; tree a strong grower: it bears freely when the roots are restricted and grown under glass.

NOIRE D'ESPAGNE.—Fruit small, round, without ribs ; skin black, covered with a blue bloom, handsome, cracking when ripe ; flesh deep rose-coloured, juicy, very sweet ; earlier than Black Bourjassotte.

II.—FRUIT BROWN OR TAWNY.

BROWN ISCHIA.—Fruit medium, roundish turbinate ; skin light brown or chestnut coloured ; flesh purplish red, sweet, and high flavoured ; tree bears freely, good for pots.

BROWN TURKEY (Dwarf Prolific, Lee's Perpetual, Osborne's Prolific).—Fruit large, pyriform ; skin brownish red or tawny brown, covered with blue bloom ; flesh dull red, juicy, richly flavoured ; tree hardy, very prolific ; the most useful, and generally grown as a standard outdoors, and trained against walls ; also good for forcing.

BRUNSWICK (Boughton, Clare, Figue d'Or, Hardy Prolific).—Fruit very large, pyriform ; skin greenish yellow on the shaded side, tawny brown on the sun side ; flesh opaline, tinged with red, juicy and, when well ripened, rich and excellent ; tree hardy, strong growing, good for covering high walls outdoors. The most generally grown outdoor wall fig, but not a free bearer unless the roots are restricted. Castle Kennedy resembles Brunswick, and like it is a shy bearer when grown in deep rich soil.

DE L'ARCHIPEL.—Fruit large, obovate ; skin reddish or tawny brown, dotted with grey ; flesh pale rose colour, juicy, rich, and excellent grown under glass ; tree a great cropper.

EARLY VIOLET.—Fruit small, roundish ; skin brownish red, covered with blue bloom ; flesh red, juicy, and well flavoured ; tree remarkably prolific, very early, good for growing in pots, and early forcing.

GRIZZLY BOURJASSOTTE (Bourjassotte Grise).—Fruit medium, round, yet flattened, almost oblate ; skin dull brown or chocolate, with white bloom ; flesh deep blood-red, thick, juicy, syrupy, rich and luscious, constantly good ; tree a good cropper.

POULETTE.—Fruit medium to large, roundish, obscurely ribbed ; skin deep green, streaked and mixed with brown, and covered with grey bloom, cracking when fully ripe, then becoming brown ; flesh dark red, very juicy, syrupy, and rich. A handsome and good fig ; tree a free grower and bearer.

III.—GREEN, YELLOW, OR WHITE.

AGEN.—Fruit medium, roundish turbinate ; skin green, chocolate at the eye intermingled with green, covered with blue bloom, and cracked in white reticulations when fully ripe ; flesh deep blood, thick, syrupy and very rich ; tree a good grower, great cropper, ripening late ; requires heat as it is one of the latest of figs.

ANGELIQUE (Madeleine).—Fruit small to medium, rounded turbinate, flattened ; skin yellow, dotted with greenish-white specks ; flesh white, tinged with rose in centre, juicy, sweet, perfumed ; tree an abundant bearer, suitable for warm walls, growing in pots, and for forcing.

COL DI SIGNORA BIANCA.—Fruit medium, pyriform ; skin thick, green, change to yellowish-white, covered with grey bloom ; flesh blood-red, thick, syrupy and luscious ; tree strong grower, late.

MONACO BIANCO.—Fruit large, obovate ; skin pale green ; flesh deep red, very juicy and richly flavoured, mid-season ; tree a good bearer.

NEBIAN (Grosse Verte).—Fruit large, obovate, obscurely ribbed ; skin bright pea-green, becoming yellowish when mature ; flesh bright red, firm, rich and luscious ; tree good grower, free bearer, ripens late.

ST. JOHN'S.—Fruit medium, rounded turbinate ; skin green, changing to yellow with long greenish-white specks ; flesh white, juicy, and well flavoured ; tree a free bearer, early, good for pot culture and forcing.

WHITE ISCHIA (Singleton).—Fruit small, turbinate, on long stalks ; skin greenish-yellow, tinged with brown ; flesh pale, tinged with red, juicy, rich, and highly-flavoured ; tree a great bearer, suitable for pot culture and forcing.

WHITE MARSEILLES.—Fruit medium to large, roundish pyriform ; skin pale green ; flesh pale, very juicy, and when well ripened richly flavoured ; tree hardy, prolific, early ; suitable for walls outdoors, pot culture, and forcing.

SELECTIONS OF FIGS NAMED IN ORDER OF RIPENING.

Six varieties for high quality.

Black Bourjassotte.
Poulette.
Grizzly Bourjassotte.
Monaco Bianco.
Col di Signora Bianca.
Nebian.

Three for high quality.

Monaco Bianco.
Grizzly Bourjassotte.
Nebian.

Best quality fig.

Grizzly Bourjassotte.

Six useful varieties.

St. John's.
Black Ischia.
White Marseilles.
Brown Turkey.
Negro Largo.
Gouraud Noir.

Three useful varieties.

White Marseilles.
Brown Turkey.
Negro Largo.

Best all-round fig.

Brown Turkey.

RELATIVE TO SIZE.

Six large and excellent.

Brunswick.
Black Genoa.
Brown Turkey.
Large Black Douro.
Negro Largo.
Nebian.

Three large.

Brunswick.
Negro Largo.
Nebian.

Best large fig.

Nebian.

Six medium or small good.

St. John's.
Early Violet.
Angelique.
Black Ischia.
White Ischia.
Black Provence.

Three medium or small.

Black Ischia.
White Ischia.
Black Provence.

Best small fig.

White Ischia.

SELECTIONS FOR VARIOUS MODES OF CULTURE.

FOR POTS IN UNHEATED (OR HEATED) STRUCTURES.

Compact growers for small pots.

St. John's.
Early Violet.
Angelique.
Black Ischia.
Black Provence.
White Ischia.
De l'Archipel.
Poulette.

Large growers for large pots.

White Marseilles.
Brown Ischia.
Brunswick.
Brown Turkey.
Grizzly Bourjassotte.
Negro Largo.
Col di Signora Bianca.
Nebian.

FOR PLANTING OUT UNDER GLASS.

In cool houses, or in heat.

White Marseilles.
Brunswick.
Large Black Douro.
Brown Turkey.
Negro Largo.

Requiring heat (late).

Nebian.
Col di Signora Bianca.
Agen.

FOR OUTDOOR CULTURE.

Dwarf standards (small).

Angelique.
Black Provence.

Standards (large).

White Marseilles.
Brown Turkey.

FOR WALLS.

In small garden.

St. John's.
Early Violet.
Angelique.
Black Ischia.
Black Provence.
White Marseilles.
Brunswick.
Black Genoa.
Grosse Menstrueuse de Lipari.
Brown Turkey.

FOR FORCING.

Earliest in pots.

St. John's.
Early Violet.
Angelique.

Second early

Black Ischia.
White Ischia.
Black Provence.

General crop.

White Marseilles.
Brown Turkey.

Earliest planted out.

St. John's.
White Marseilles.
Brown Turkey.

Main.

Monaco Bianco.
Negro Largo.
Grizzly Bourjassotte.

Late.

Nebian.
Col di Signora Bianca.
Agen.

PROPAGATION AND CULTURE.

Propagation.—This is easily effected by seed, offsets, layers, and cuttings or eyes, also by budding and grafting.

Seed.—Seedling fig trees are easily raised, but the trees take many years to arrive at a fruiting state, and this method of obtaining them is not recommended. Persons, however, who may be desirous of raising improved and hardier varieties should save seed from the finest and ripest fruit, cleanse the seeds from the pulp, sow them in rich light soil in January, and grow the plants as rapidly as possible. To ensure early fruiting they may be grafted, or inarched on old trees, when they may fruit in the third year, but on their own roots they may not fruit till the sixth or seventh year, if then.

Offsets or Suckers.—Young shoots spring from near the base, around the crown of the tree, and, when taken off, have generally a small portion of root attached. These, if planted or potted at once, soon form trees.

Layers.—Bend the branch of a tree down to the ground, cover the previous year's shoots with fine soil, make them fast with pegs, and leave the points of the shoots a few inches above the surface. A cut upward, or a notch made about half way through the wood, immediately below a joint, arrests the sap, causing the emission of roots. Keep the soil moist and fine plants will be formed by the end of the season, if the layering is done before vegetation commences early in spring.

Cuttings; Eyes.—This is the simplest and most practical mode of increase, as every bud may be turned to account. Ripe young wood is suitable cut into pieces containing two buds (Fig. 15, *c*, Vol. I., page 100), or into single eyes (Fig. 16, *j*, page 101). Where a few plants only are required the simplest and best form of cutting is a shoot of the previous season's growth taken off with a heel of the older wood, as shown in Fig. 16, *h*, page 101, Vol. I.; these represent the cuttings after the formation of roots. Stubby, short-jointed, well-ripened wood forms the best cuttings, and strikes the most readily. One-year-old wood is the best; long, spindling, badly-ripened shoots the worst. The best season for inserting cuttings is January or February, taking them off while the trees are at rest; if taken after the sap is in motion the milky exudation prevents rooting, and the same difficulty is experienced with the young growing shoots in summer. Towards autumn, when the wood is ripening, it strikes more freely. Cuttings taken in late summer may be rooted in a warm border outdoors, but a moiety only will strike under cool treatment.

All the buds of the part on the cutting to be inserted in the soil must be removed.

The cuttings may be placed singly in 3-inch pots, using light rich soil, or several can be inserted in a pot, pan, or bed in some loose cocoa-nut refuse with sand, under a bell-glass or in a close frame on a fermenting bed, or over a hot-water tank. In a bottom heat of 70° to 75° the cuttings produce roots in about ten days, the top heat being 60° to 65° artificially. They should then be placed in 3-inch pots, and when these are filled with roots, be shifted into 5-inch pots, as should those placed in 3-inch pots at the commencement, and be grown in a temperature of 60° to 70° , with 10° to 15° more from sun heat. In the early stages, the assistance of a little bottom heat is advantageous, but it is not necessary after the plants are established.

Budding.—The common shield method may be employed, operating as soon after midsummer as the buds are sufficiently formed, and after tying cover with grafting wax

so as to exclude the air, as the bark of the fig shrinks in drying. Annular budding is considered the best for the fig, and should be performed in late summer, or when the wood is ripening. As this method of budding is applicable to the walnut and chestnut we give an illustration.

In annular budding a ring of bark 1 to 2 inches wide is taken off the stock by running two circular cuts around it at the place fixed upon, and making a vertical cut between the two circular cuts. The haft of the budding knife is then introduced into the slit and the ring of bark carefully removed. In a similar manner a ring of bark is taken off the variety to which the

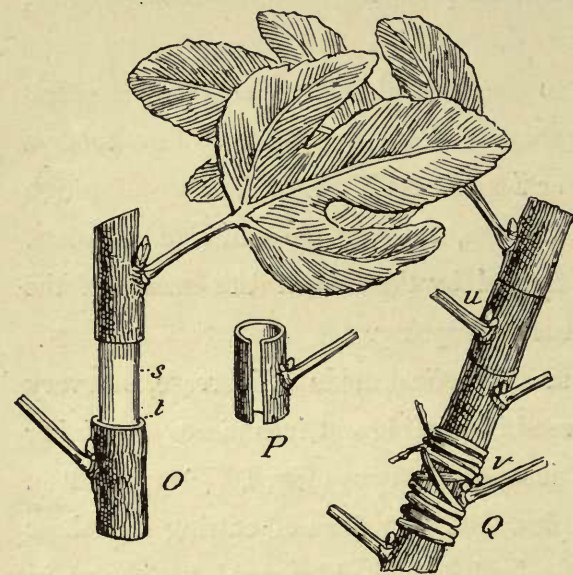


Fig. 55. ANNULAR BUDDING IN FIG TREE.

References:—O, stock prepared for bud; S, ring of bark taken off; T, lower cut; P, bud prepared; Q, stock showing; U, bud placed in position; V, bud tied.

bud is to be attached. This ring (P) must have one bud at least, and should exactly fit the stock, particularly at the lower cut, so that both barks join. Secure the ring-bud rather firmly with cotton. In a fortnight or three weeks the bud will have taken, and the bandage may be removed. The branch or stock must be cut down to 3 inches above the budding in spring. This ingenious French method is useful when it is necessary to put fruitful parts on barren trees, a number of varieties on one stock, or render seedlings usefully productive.

Grafting.—This may be performed after the stock has broken into leaf. Whip grafting is best for small, and cleft grafting for large stocks, making the cut in the former neat and short, and running hot wax into the cleft between the scions, binding tightly and covering with grafting wax. Grafting by approach is easily effected, operating when the stock and scions are growing, letting them grow together till the autumn, then severing the connection, and retaining the growths only that are required for bearing. For methods see pages 123, 133 and 135, Vol. I.

Situation.—The fig succeeds in warm southern localities as bushes or standards, where there is but little depth of soil. We have seen trees in Hertfordshire, growing in gravelly loam, on chalk, which have not failed to ripen abundant crops during twenty-seven consecutive years. In all cases of success with standard trees, the soil has been warm, gravelly, or porous, the situation open to the south, but protected by hills, banks, or buildings from the north; and the trees thrive in old chalk-pits open to the sun, where the roots are free from stagnant water. Generally, however, it is only against walls that figs can be cultivated in Britain; they succeed even in northern districts bordering on the sea, as at Wilton Castle, Yorkshire, and Cullen House, Banffshire, where grand crops of figs are produced on south aspects. A wall facing the south is the best generally, but trees may be occasionally seen fruiting abundantly against the east and west gable ends of houses, with overhanging roofs. But soil influences the fruitfulness of fig trees as well as position, for a tree planted in a paved yard, against a building or in a gravel path, against the south side of a cottage with projecting eaves, will produce quantities of excellent figs, whilst a tree planted in rich deep soil of unlimited extent, against a garden wall, generally produces nothing beyond a luxuriant crop of leaves.

Soil.—Any kind of soil will not grow good figs. The tree thrives against buildings and in lime rubbish, because of the nitrate of lime, and there is seldom any lack of ammonia, potash, and soda around buildings. The best results are obtained from a calcareous loam, interspersed with flints, resting on chalk, and it must be firm, for in a rich, loose, deep soil the roots run riot, and the growths are exuberant. With a limited rooting area and firmer soil there would be fewer barren fig trees; yet the fig loves moisture, therefore the soil must not be impervious to rain or water, and the subsoil must be open to let superfluous water filter away. This is important, for stagnant water means fruitless trees.

Arrangement.—It is undesirable to place the trees a great distance apart, as they are

liable to be injured by frost and may thus need cutting back occasionally. Standards may be planted 12 feet asunder in rows 15 feet apart. Against buildings or high walls, the trees may be placed 9 to 12 feet apart; against walls 10 to 12 feet in height they may be 12 to 15 feet asunder, lifting and root pruning as may be needed to keep them sturdy and fruitful.

Planting.—This may be performed in autumn when the leaves turn yellow, but with trees established in pots planting is best done in April, the trees having been kept cool, yet safe from frost, during the winter. Turn them out of the pots, remove the crocks, disentangle the roots, remove all suckers, cut out every bud on the part to be covered with soil, shorten the strong roots, spread the smaller out evenly, work the soil amongst them, not covering the uppermost roots more than 2 or 3 inches deep, and make the soil firm under and over them. If it is dry give a good watering. Afford a light mulching before hot weather sets in; if planted in the autumn, spread some dry littery material on the surface, from the stem outwards to 1 foot beyond the spread of the roots. Stake and tie standards, and secure trained trees loosely to the wall or trellis.

Form.—To shape a tree that will bear freely requires judgment, and a knowledge of the natural habit of the fig. Left to itself, it pushes a number of suckers from the root, and becomes unshapely and unfruitful; therefore, confine the tree to a single stem. The form of the head must accord with the mode of culture. There are two modes of growing the fig—1, low bushes or open standards; 2, fan shape.

Standards are simply bushes with long stems. Half-standards should have 3-feet stems, and, except for special positions, these are ample for the tree, especially where annual lifting is practised. In any case train with an evenly balanced open head, for crowding is fatal to fruitfulness.

Fan-shaped trees are the most suitable for walls and trellises. The tree must have a clear stem above ground, from which the branches may radiate, and these must be thinly trained so that the leaves are exposed to the direct rays of the sun.

The cutting being struck, potted off, and shifted into a 5-inch pot when large enough, its growth the first season should be confined to the formation of a sturdy single stem, pinching out the growing point three leaves above the required point of shortening in winter. The stopping will give the plant greater strength and induce two or three growths from the upper joints to appropriate the sap and prevent the pruning buds starting; but if these push, pinch the growths, and all side shoots, at the first leaf, rubbing off any growths springing from the base. Give the tree all the light possible to

become sturdy and well ripened. To form a bush cut the year-old tree back at the desired height, leaving four buds at the upper part; train the growths from them the following year so as to form an open head, pinching them at the fifth leaf, and so proceed as fresh growth is made. The point of pruning the first year is shown in Fig. 56, *S*, at *a*; and the growths in the second year are represented in *T*, the outlined shoot being the fourth; and the point of pinching is indicated by the dotted bars.



Fig. 56. ORIGINATING ROUND-HEADED AND FAN-SHAPED TREES.

References.—*R*, a fig cutting striking. *S*, the young tree shifted into a larger pot and grown with a single stem; *x*, disbudded shoots; *y*, point of stopping; *z*, laterals; *a*, point of winter pruning. *T*, tree in the second year, showing formation of head for a bush, all four shoots; for a fan; *b*, leader; *c*, point of shortening it in winter; *d*, side shoots unpruned. The dotted bars indicate points of stopping to form a bush.

Fan Shape.—This form may be originated by heading the one-year-old tree at 1 foot from the ground, cutting out all the eyes except three of the uppermost, leaving those from which the dotted lines issue in the above Fig., *S*. During the first year a 5-inch pot suffices, and a 7-inch pot is ample in the second, if the compost is sound and firm. Afford

the tree unobstructed light, with free ventilation; then the growths in the second year will be stout, short-jointed, and well ripened, without pinching, as shown in *T*. At the end of the second season the tree will be suitable for planting against a wall or trellis. After planting, the side shoots, if not more than 12 to 15 inches long, need not be shortened, but should be brought down nearly horizontally, and the leader should be cut back in autumn to about six joints, Fig. 56, *T*, *c*, full bar.

Trees received from nurseries for covering walls and trellises often have several shoots. Select the best placed and remove the others; the chief points to aim at are a clean stem, with three to five shoots radiating from it, evenly disposed and spread out like the ribs of a fan.

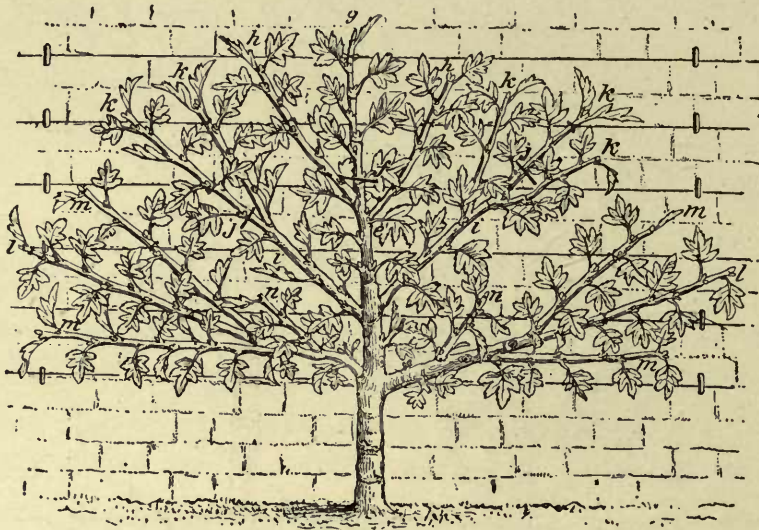


Fig. 57. FAN-TRAINED FIG TREE AGAINST WALL.

References :—*e*, leading shoot stopped at the bar *f*; shoots, the results of pinching—*g*, upright; *h*, side growths; *i*, spring originated side shoots, pinched at the bars *j*; *k*, growths resultant of pinching; *l*, continuations; *m*, laid-in growths; *n*, stopped shoots.

The tree having three branches when planted and being trained and pruned, as described, from a cutting forward it will, in the third season, push three growths from the central cut-back branch; take one upright, and one on each side at an angle of about 45°. When the leading shoot has made six good leaves, pinch off its point; this gives rise to three shoots; train one upright and one on each side similar to those originated in spring, pinching other growths at the first leaf, but rub off all foreright shoots. The two side branches of the preceding year may push several shoots each. Train one forward in continuation, spreading the others so as to cover the space evenly, but these depressed branches often push growths down to the base, and the mistake is made in

laying all in, so that the branches are ultimately jammed. This must be avoided by rubbing some of the shoots off. At the close of the third season the tree has a foundation, from which sufficient growths will start to cover the wall space without shortening the branches to produce more. The tree in the illustration, Fig. 57, is representative of what a fan-trained fig tree ought to be, namely, single-stemmed and with thinly-disposed branches, instead of, as usually seen, a mere thicket with suckers springing from the root.



Fig. 58. CHARACTERISTIC GROWTHS AND FRUIT PRODUCTION IN THE FIG.

References :—*U*, indoor branch : *o*, last season's terminal growths ; *p*, embryo figs in bud ; *q*, first-crop figs—the two lowest ripe. *V*, current year's growth : *r*, second-crop figs ; *s*, third-crop figs—trees started early and kept growing till late—otherwise first crop in succeeding year. *W*, outdoor branch : *t*, last year's wood ; *u*, first-crop figs ripe (August or September) ; *v*, current year's growth ; *w*, second-crop figs—generally worthless ; *x*, embryo figs—first and only crop generally of the following year. *X*, weak, sappy, crowded shoot of last season—destitute of embryonic figs. *Y*, similar shoot to *X*, but grown under full exposure to sun, and pinched *y*. *Z*, result of growing thinly and pinching : *z*, embryo figs—succeeding season's first crop.

Characteristics of Bearing.—Fruit production in the fig is distinct from all our commonly grown fruit trees. Instead of producing one crop only it will bear two, and even three crops in one season, but on distinct growths. The first crop of each year is borne on the wood of the previous season's formation ; the second crop (also

third) is produced in the axils of the leaves on the current year's wood. The first crop ripens outdoors in August and September, but the second crop rarely ripens in this country in the open air. Yet the fruits become large and remain on the trees after the leaves fall, simply failing to arrive at maturity through want of heat; these are often jealously protected under the belief that they will develop in spring and form the first crop of the year, yet they are not worth consideration. A few may, under very favourable conditions, remain on and ripen in June, but this is very seldom. Examples of production are shown in the illustration on the opposite page.

Pruning.—It must be distinctly understood that fig trees only fail to produce fruit from two causes—(1) immaturity of the wood, which fails to form fig buds; (2) cutting off the bearing shoots. The first may be due to insufficient heat, shade, crowding, over-luxuriance, or errors in management; the latter can only happen through lack of knowledge. If we cut back the fruit-bearing shoots (Fig. 58, *U, o*) to the bars, we destroy the first crop, and, without highly favouring conditions of heat and light, the second crop also, inasmuch as the shoots produced after close pruning are frequently of a soft and unfruitful nature. If a standard or wall tree have its fruit-bearing shoots shortened to the bar, as in *W*, no fruit can be produced the succeeding season. Shoots, however, corresponding to those in *X*, may be cut back without loss of crop, yet it would have been wiser to pinch the growth of such shoot in the summer, as shown in *Y*, and transform it into fruitfulness, as represented in *Z*, thereby saving a year and gaining a crop. The adage, "A pruned fig tree never bears," is to a certain extent true, and severe pruning is followed by a distinct loss of fruit. Yet the knife must at times be used to keep the trees in form and within certain limits. Trees in the open air, also those planted in houses, with or without heat, are generally inclined to vigour of growth. They produce the finest fruit under favourable climatic conditions, the pruning being confined to thinning out exhausted and useless branches, and maintaining a succession of bearing shoots throughout the trees. Those are grown on the extension system, but a portion of the growths are pinched to form spurs (so called), yet only where there is not room for extension. Systematic restriction is only possible when the roots of the trees are under the control of the cultivator, as those in narrow borders or in pots, which if well managed bear abundantly.

The foregoing points in fig culture must be remembered. Outdoor trees and those grown in unheated houses can only be depended on to produce one crop in a season;

both the first and second crop may be had from trees grown in heat on the extension system with a limited extent of summer pruning, and in no case can first-crop figs be had by cutting off the growths of the preceding year, non-pruning being essential to the fruiting of such shoots. Even with trees in pots the previous year's shoots must not be cut if an early first crop is desired.



Fig. 59. PRUNING WALL AND TRELLIS FIG TREES.

References :—*A*, branches showing winter pruning : *a*, extremity shoots of last season, having borne fruit, are to be cut away at the bars ; *b*, outlined leaves to attract sap to the fruit ; *c*, successional shoots for future bearing ; *d*, useless wood cut out at the bar in favour of promising shoot, *e*. *B*, worn-out branches outlined, to be cut back to the bars, *f* ; *g*, growths for supplanting those which have become unprofitable. *C*, branch in foliage and fruit showing summer pruning : *h*, extension growths, reached the limit and producing fruit ; *i*, first crop ; *j*, second crop ; *k*, point of pinching, pruning at the lower bar when the fruit is gathered ; *l*, successional shoots unpinched ; *m*, first crop ; *n*, second crop ; *o*, growth on which first crop of the following year is borne ; *p*, pinched shoot to accelerate second crop ; *q*, spur shoot pinched at the sixth leaf. *D*, branch showing right and wrong practice ; *r*, crowded growth, barren ; *s*, thin growths, sturdy and fruitful ; *t*, spur shoot pinched at the second leaf—useless for fruit, but useful for originating growth.

Winter Pruning should be performed as soon after the fall of the leaf as possible, whether the trees are in the open air, planted under glass or in pots, but where proper summer treatment is given the knife will be little needed in winter. The best practice is to cut out all the wood not wanted after the fruit is gathered, and so

give the growth left the benefit of the increased light thereby admitted. When the trees are pruned before or just after the fall of the foliage, the wounds soon heal over, but if the work is delayed until the sap is in motion, the shoots are apt to die after the knife. Branches of almost any age may be cut off at any part, and young shoots will be produced quite freely; if too numerous, they must be reduced early to the required number.

Summer Pruning must be resorted to for preventing overcrowding. The leaves of the fig being large, the branches and shoots should be kept sufficiently far apart to prevent the leaves of the one from interfering with those of the other. A good deal of shoot-thinning is therefore required. Disbudding may be practised with great advantage, as more shoots push in spring than can be allowed sufficient space to develop, and it is better to rub off those not required than to remove subsequent growths in large quantities. Sometimes there is not space enough for a growth to be laid-in at full length, but room for a short one—a shoot pinched at the fifth or sixth leaf; yet no more of such growths should be encouraged than can receive the direct rays of the sun. That is a vital condition always to be remembered in pruning fig trees. The foregoing instructions on pruning apply to outdoor trees on walls, also to those trained on trellises under glass, and the subject may be further elucidated by studying the illustration on the preceding page.

The principles of pruning fig trees ought now to be clear to attentive readers, but we must refer briefly to the roots. These ought to be in firm soil; then, if the rooting area is limited, little pruning will be required.

Root-pruning is rendered necessary at times to repress the excessive vigour of the fig and induce fruitfulness. The operation should be done as soon as the leaves commence falling, never delayed beyond their immediate fall, for if put off until spring it endangers the first crop of fruit. The trees should be taken up, the roots shortened, and then replanted. Some trees will require much root-pruning, others little; the cultivator, seeing the condition of the roots, is enabled to act according to the need. Young trees often grow strongly and are tardy in bearing, but if lifted and root-pruned every season they become, in a short time, marvels of productiveness. Rampant growing trees, of whatever size or age, submit to the practice, and it causes the production of short, stubby, fruitful wood in trees under glass equally with those outdoors.

Preparing Borders.—Exuberance is a characteristic of border fig trees, therefore the quantity of soil should be very limited in extent, the borders for trees against walls

or trellises not needing to be more than 4 to 6 feet wide. One-third the height of the wall or trellis is, in many cases, more advantageous than a border of greater width. Where the subsoil is loose and rich, the bottom of the border should be concreted, and the roots limited to the given area by a solid brick wall, built on the concrete. The bottom must incline to a drain having due fall and proper outlet. Provide 12 inches in depth of brick rubble for drainage, on which place a layer of old mortar rubbish or chalk 3 inches thick, and over this 18 inches to 2 feet in depth of soil. These are minimum and maximum depths; the soil to be firm.

Compost for Borders, Stations, and Potting.—Fig trees delight in sea air—its salt dissolves the silica in the soil, and a calcareous or gravelly stratum causes them to grow sturdily. In the absence of a naturally calcareous soil a proper compost must be prepared. This should consist of good hazel or yellow loam—the top 3 or 4 inches of a pasture broken up moderately small—four parts: if inclined to be light, add one-fifth of chalk in lumps not larger than a hen's egg, and one-sixth of clay marl dried and pounded: if inclined to be heavy, add one-fifth of old mortar rubbish and a sixth part of burned clay, incorporating well. No manure is needed for borders, as the roots are best attracted to the surface by top-dressings and mulching, when nutrient elements can be given as required. Almost any loamy soil will, however, grow good figs if one-fifth of old mortar rubbish be mixed with it, and made firm on a foundation of rubble efficiently drained. Fig trees will thrive better on a heap of stones or lime rubbish than in the richest land, provided there is enough soil to fill the interstices and the whole is compact. For potting, four parts of fresh yellow loam, one part of old mortar rubbish, one part of well-decayed stable manure, with a sprinkling of crushed $\frac{1}{2}$ -inch bones, form a suitable compost. A tenth part of wood ashes is sometimes added advantageously, both for trees in pots and borders.

Manures.—The essential nutrient elements needed by figs are potash and soda. Lime and magnesia are important constituents, and enough is generally present in calcareous soil, but when it is desirable to afford more of those elements, as in the case of trees in pots and small rooting areas, they may be applied in the form of phosphate of lime and sulphate of magnesia. Nitrogenous elements are of essential importance.

A suitable mixture for the fig consists of superphosphate of lime, 3 pounds; nitrate of potash, 1 pound; sulphate of magnesia, $\frac{1}{4}$ pound; chloride of soda, $\frac{1}{4}$ pound; mix and apply at the rate of 2 to 3 ounces per square yard when the buds commence swelling, and when the first crop is just gathered. Trees in pots may have more frequent applications

but in lessened quantity. If more vigour and larger fruit are desired substitute nitrate of soda for the sulphate of magnesia and chloride of soda.

Top-dressing.—Trees bearing heavy crops of fruit in pots and narrow borders require a liberal surface dressing of rich compost when they are in active growth, and the first crop of fruit fairly set. Equal parts of turfy loam about the size of a hen's egg and fresh horse-droppings, with a quart of steamed bone-meal, 2 quarts of wood ashes, and 2 quarts of small charcoal to every bushel of loam used, the whole well mixed, answer well. The roots spread through it quickly, and when these become matted, another top-dressing should be applied. Strips of turf may be pinned around the edges of pots, or pieces of zinc 4 inches wide placed within the rims for raising the top-dressing above the pots. The roots of the fig feast on the rich fare, and the fruit is well nourished. Renew the top-dressing for the second-crop fruits.

Mulching.—This is only another form of top-dressing, partially decayed stable or farmyard manure being employed to assist planted-out trees in dry periods in swelling their crops. Trees outdoors only require it when fruitful, and in restricted rooting area, applying it when the fruit is fairly set. Trees under glass should be mulched for the second as well as the first crop, having the material rather lumpy and about 2 inches thick.

Watering.—The fig is a gross feeder, and requires an adequate supply of water, but outdoor trees only need watering in dry seasons, whilst the fruit is swelling, a too moist soil prejudicing the crop when ripening. Trees in properly constructed borders under glass should never lack water whilst in growth, especially during the swelling of the crops; but when the fruit is ripening, water must be applied to the roots more sparingly, as an excess of moisture then is apt to impair the flavour and cause the fruits to split. Trees in pots can scarcely have too much water when the crops are swelling. But it should be gradually reduced when the fruits show signs of ripening, giving no more than is necessary to keep the leaves in a healthy condition; the fruits will then ripen perfectly without prejudice to the second crop. As soon as the first crop is gathered give water freely until the second crop commences ripening; then keep the soil rather dry till the foliage matures. Whilst the trees are at rest, even in pots, they only need moisture in the soil to prevent the shrinking of the wood.

Protecting in Winter.—Except in favoured places in the south of England, as well as the seaboard in other localities, protection must be given to fig trees, otherwise they may be killed to the ground in severe winters, especially those following a wet summer.

Spruce branches fastened in front of the trees, commencing at the bottom of the wall, and proceeding upwards so as to form a sort of thatch, answer well, as their leaves drop off towards the spring when the trees need less protection. Generally the better plan is to liberate the branches, and tie them in convenient bundles for covering them thickly with fern or straw encased with matting. This should be done shortly after the leaves fall, taking care to uncover the trees before growth commences in the spring; this should be done gradually, the mats to remain on the trees for a few days after the fern or straw has been removed. Care must be taken to protect the main stem, otherwise it is useless covering the branches. After the branches are adjusted to the wall, mats may be suspended in front of the trees on frosty nights. A projecting glass coping is excellent for trees against walls, both for protection in spring and for accelerating the ripening of the crop in summer.

Trees under glass in unheated houses should be covered with dry fern or straw when leafless, similar to wall trees, and be kept so until March or early April, then uncovered. Trees in pots ought to be protected from frost during the winter, also be kept dry at the roots. In heated structures fig trees should be kept cool and dry whilst at rest, employing fire heat only to prevent the temperature falling below freezing point.

FIGS UNDER GLASS.

Though the fig may grow in any aspect and situation, it only bears fruit freely and of the highest quality under the full and direct influence of the sun; therefore, the fig-house, unheated or heated, must be very light, and also have provision for free ventilation. The tree succeeds trained to a glass-covered wall, provided the light is unobstructed. It is better to have the lights nearly perpendicular, or only so far from the wall as to admit a person inside for attending to the trees, than to have a roof reaching from the wall double the distance. In the latter case it is a good plan to train the trees with one or more stems up the wall, and then train the branches down the roof. If they are disposed thinly on a trellis 15 inches from the glass, they often become wonderfully fruitful: the sun acts full on the points of the shoots, whilst the downward training checks the tendency to over-luxuriance. That method is strongly recommended in lean-to houses with long sloping roofs. Three-quarter span-roofed structures, such as that represented in the illustration (E, page 189), facing south, answer admirably for figs.

Span-roofed houses are the best of all for bush, pyramid, and low standard trees, because there is plenty of light on all sides, and with the ends north and south the sun during some part of the day penetrates into the hearts of the trees if the branches be thinly disposed. A span-roofed house 100 feet long, 30 feet wide, 5 feet high to the eaves, and 12 feet to the ridge, in the gardens of the Royal Horticultural Society at Chiswick, contains the finest collection of figs in the kingdom. They are grown in pots of various sizes, arranged on a central bed, also on side stages, and bear prodigiously.

All fig-houses must have ample means of ventilation, and a free circulation of air is indispensable when the fruits are ripening. Though figs may be grown in unheated houses, all are best with sufficient piping provided to maintain the requisite warmth without heating the water to near the boiling point. Where ripe figs are not wanted before July, little heat is required, except in cold weather, and to assist the later varieties in ripening. Unheated houses only afford a short supply of fruit, but trees assisted with heat from March furnish luscious figs from July to November inclusive, at no great expense in fuel, if properly selected varieties be grown in pots.

Temperature and Ventilation.—The fig starts into growth outdoors about the beginning of May, mean temperature 51° , and ripens one crop of fruit in August and September; to ripen two crops the trees must be started in March, in a temperature of 50° at night, 55° sufficing by fire heat on cold days, until the trees are fairly in growth, but it may rise with sun heat to 70° or more. When the lowest leaves attain to nearly their full size the temperature should be gradually raised to 65° in the daytime, artificially, falling 5 or even 10 degrees on cold nights, as a low temperature at night is preferable to a high one. Afford a little ventilation when the temperature reaches 65° by sun heat, advancing to 70° or 75° with increased air.

When the first leaves are full sized observe 75° as the point for commencing top ventilation. The temperature from sun heat should be kept at 80° to 90° through the day, and by closing early in the afternoon it will rise to 90° or 100° , or even higher— 120° occasionally not injuring figs, and this will ensure ample warmth through the night without having recourse to much, if any, fire heat. When the fruits show signs of ripening, more air must be admitted, and a drier and more bracing atmosphere secured by gentle warmth in the hot-water pipes. The second crop will then ripen and the wood be well matured preparatory to the trees being allowed to go to rest. Unheated houses must not be kept close in the early stages of growth, but

air ought to be admitted freely, and after the first leaves attain nearly full size the sun heat should be husbanded by early closing, following with free ventilation when the fruits are ripening.

Atmospheric Moisture.—Figs, while growing, delight in a humid atmosphere. Outdoors, as a rule, they have enough, often too much, for the production of fruit. In unheated houses little atmospheric moisture is needed in the early stages of growth and none after the fruit changes for ripening. It is sufficient to damp the border and paths in the morning, syringing the trees early in the afternoon of fine days when

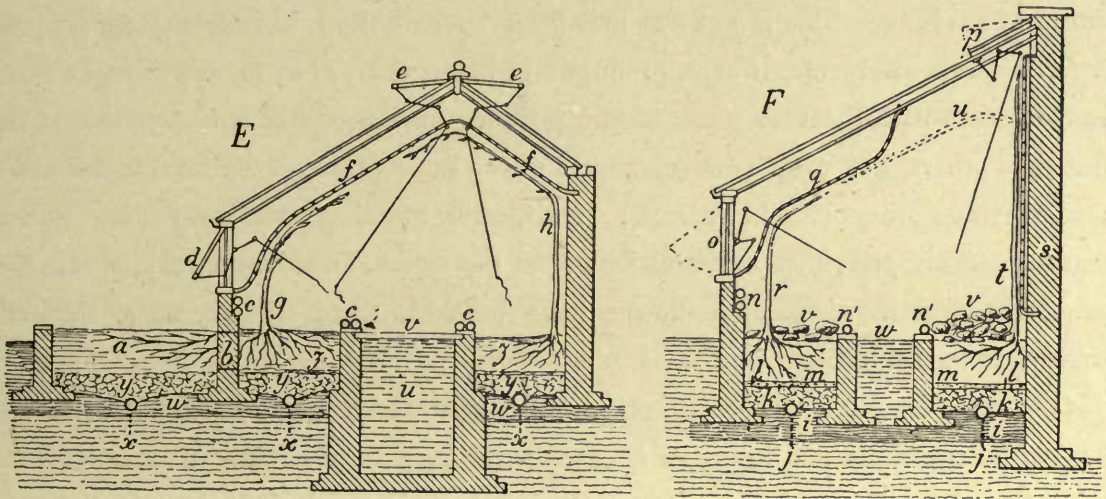


Fig. 60. THREE-QUARTER SPAN-ROOFED (section through H2, ground plan, p. 71, Vol. I.), AND LEAN-TO FIG HOUSE.

(Scale: $\frac{1}{8}$ -inch = 1 foot.)

References:—*E*, three-quarter span-roofed house; *u*, rain-water tank-walls built in cement, cemented inside, and covered with flags forming the path; *v*; *w*, concrete; *x*, drains; *y*, drainage; *z*, borders; *a*, outside border, for use if necessary after the inside is occupied with roots; *b*, opening in wall to let the roots outside, but closed till wanted; *c*, 4-inch hot-water pipes (half only if the trees are not forced early); *d*, front lights; *e*, top lights; *f*, trellis 15 inches from the glass; *g*, front trees trained up the roof; *h*, back trees trained down the roof. *F*, lean-to house, 12 feet wide inside; *i*, concrete, or bricks laid flat run with cement; *j*, 3-inch tile drains; *k*, rubble 1 foot thick; *l*, a 3-inch layer of chalk or old mortar rubbish; *m*, borders; *n* and *n'*, 4-inch hot-water pipes (*n*, only if the trees are not forced early); *o*, front lights; *p*, top lights; *q*, front trellis—*r*, front trees; *s*, back wall, wired—a bad position; *t*, wall trees; *u*, training down the roof—best method for strong-growing varieties; *v*, feeding by turves on borders—a good system; *w*, path.

they are in full growth in cool houses. In heated structures, and where a high temperature is maintained, the trees should be syringed twice or thrice a day in hot weather, but must by no means be kept dripping wet, and the last syringing must be done sufficiently early in the afternoon to allow of the trees becoming dry before night. The paths and all surfaces should be kept moist, and the brighter the sunshine the oftener the damping will be required. Potted trees should stand on a thick bed of ashes, from which moisture will rise, also ammonia from the waterings with liquid manure. This is highly beneficial to fig growth, and inimical to red spider. This pest quickly takes

possession of fig trees growing in a dry atmosphere, and, as syringing must be discontinued when the fruit is ripening, the floors and other surfaces should be damped occasionally for the benefit of the foliage, which must be kept healthy for maturing the second crop of fruit, and ripening the wood. After gathering all the ripe fruit, syringing may be practised on a fine day (if the foliage needs cleansing) without serious danger of injuring the fruits left, especially if there be heat in the pipes and the air is kept in motion by judicious ventilation; a stagnant atmosphere is injurious.

Trees casting their Fruit.—Young figs not infrequently fall from the trees prematurely instead of swelling. This is not due to imperfect fertilisation, as is commonly supposed, for fertile seeds are rarely, if ever, produced in this country, but to defective buds, and always occurs with the first crop. Some varieties have a greater tendency to cast their fruit than others, but even particular trees of the same variety sometimes throw off the crop, which on others is retained. The fruit, after swelling to a good size, suddenly assumes a sickly yellowish hue, and falls from the tree. The dropped fruits, when cut open, have large cavities, and no flowers have formed in them. The cause of the evil is poverty, or unripe wood.

Over-cropping, ill nourishment, attacks of insects, too much moisture and too little heat, with exuberance and improper management, share about equally in causing fig trees to cast their fruit. Sudden checks to growth are at all times injurious, but especially so at the critical stage of flowering. This occurs when the fruit is a little more than half grown, the eye then assuming a pinkish hue, and expanding a little for admitting air to the flowers. If the cultural details prescribed are carefully carried out, the wood of the trees will be in the best condition, and the crops will swell to maturity for use.

Thinning the Crops.—This is one of the most important operations connected with fig culture, but is rarely practised. Outdoor trees are commonly allowed to retain all the second-crop figs until the autumn, but they are positively useless, and instead of burdening the trees with them they should be rubbed off as they form in August, or later if they attain the size of horse-beans. Buds that do not become larger than a pea must not be removed, for these are likely to remain in the bud state over the winter, and develop into perfect fruits the following summer. In the case of trees in heated structures the cultivator must be particular in thinning the second crop, allowing no fruits to remain except those near the base of the shoots, and not too many of them there if a full first crop is wanted the following season. Trees forced early, and not too strong, yet expected to give fruit in April or May, should only carry light second crops if

any; then if the trees are kept healthy, and the wood is thoroughly matured, fig-buds will form abundantly in the autumn, though they may be only just discernible, for furnishing the first crop of ripe fruit in due season. The trees will become confirmed in that habit the longer they are subjected to the treatment advised, and increase in productiveness as they increase in age.

Protecting the Fruit.—When ripening, the fruit should be kept as dry as possible, and safe from birds. Wide eaves projecting from buildings, and glass copings on walls, throw off much wet, while small birds and predatory insects may be excluded by affixing hexagon netting in front of wall trees, and over the ventilators of houses. For protecting the fruits on standard trees there is no better plan than enclosing each fruit in a muslin bag secured to the branch; this not only protects the fruit, but prevents its falling to the ground.

Gathering the Crops.—This is best done when the fruit is cool, preferably in the morning, and for home use only when well ripened. The fruit then is bent at the neck, and droops a little, has a drop of juice at the eye, and the sides are cracked; it is then at its prime. Figs for packing should be gathered before they are dead ripe, and be placed in a cool room a short time before being sent away carefully packed in boxes. Figs are always best dished on their own leaves.

Potted Trees.—The fig succeeds well in pots, bearing fruit profusely under suitable conditions. The desirability of a single clean stem has been referred to, as such trees are more satisfactory than the low bush or many-stemmed trees. The first year the plant from the cutting or eye may be pinched at 8 to 12 inches height; this will cause three or more of the top buds to break, and when the shoots have grown about 4 inches their points should be pinched off. If grown in heat and given every advantage as regards feeding and light, the wood will be stout, short jointed, and firm by the autumn for resting in the winter. If the trees are managed well they will be capable of bearing fruit the following year, but when weak they should be cut back to about half the length of the branches. Young trees not started into growth before March or April, and grown at a distance from the glass, may take three years to form a foundation, by pinching the growths when 4 to 6 inches long. Such trees should have all the shoots shortened to half their length at the end of the third year, and the following summer ought to bear fruit. The pruning of the tree in the third year is shown by the lines across the shoots in Fig. 61 (page 192), and it is kept compact by pinching, pruning being conducted on the lines laid down under that head, and the larger the trees become the less will be the need of the knife.

Pinching.—Success in the cultivation of figs in pots greatly depends on this simple operation, the finger and thumb being employed in nipping out the soft-growing points of the shoots, as it is a bad practice to allow leaves to expand and then to have to cut them off. Young trees require closer pinching than the older. Allowing five leaves to be made before removing the points of the shoots is proper for securing fruit, but regard must be had to the vigour of the tree, for close pinching strong-growing kinds keeps

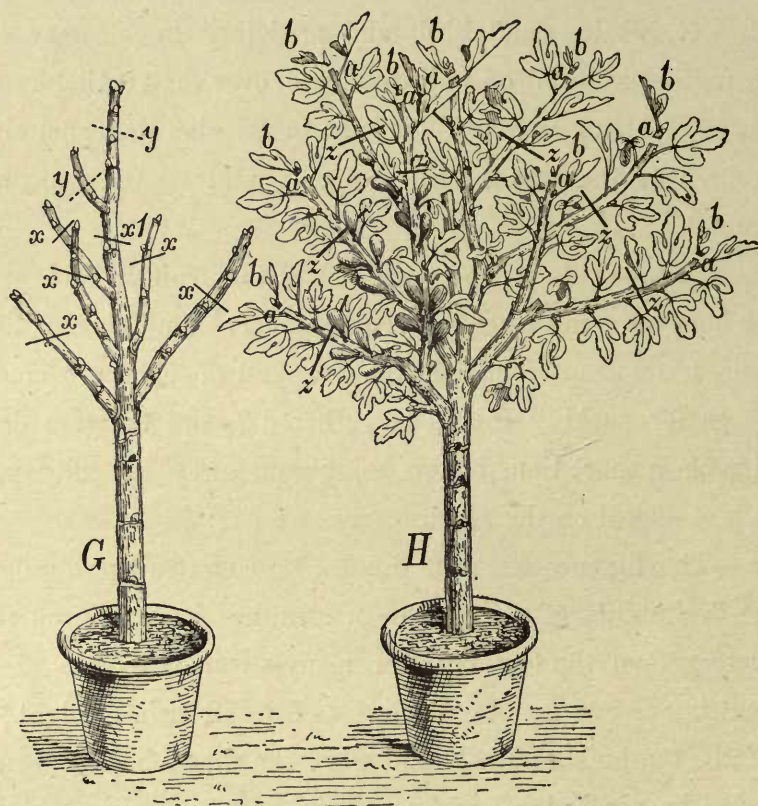


Fig. 61. PRUNING YOUNG FIG TREE, AND SUMMER PINCHING.

References :—*G*, shortening branches to form bush and pyramid trees ; *x*, points of pruning back to form a bush ; *y*, points of shortening to form a pyramid and *x*, except *x* 1. *H*, tree in foliage showing pinching ; *z*, first stopping ; *a*, second pinching ; *b*, extent of growth removed—detached points.

them barren. Cultivators must exercise judgment, remembering that the object in view is concentrating the forces on fruit production, causing second-crop figs to push at the axils of every leaf almost down to the base of the shoots, with other short-jointed growths for producing a full first crop the following season.

Potting.—The pots should have liberal drainage. A little cramping at the roots conduces to fruit production, loose potting having a contrary effect. Directly the leaves fall, turn the trees out of the pots, shake off the loose soil, shorten the roots a little, and

place in pots one size larger; then the trees can receive another shift if they require it during the following summer. This practice in shaking out the soil, trimming the roots, and re-potting, has to be performed yearly until the trees occupy the size of pot desired. Fig trees produce fruit in very small, say 6-inch pots, and are interesting and easily managed. To keep them in the smallest size of pot as long as possible, simply reduce the soil and roots and place in the same-sized pot. Very large pots are unmanageable. For general purposes 12-inch pots are convenient, though larger are used for producing a quantity of fruit of a special variety. Instead of re-potting annually, trees in large pots may have the surface soil picked off and some removed half-way down the side of the pot, shortening the roots and filling the space with fresh soil. Every second or third year, however, the trees should be turned out, have the roots reduced two-thirds, and be given clean, well-drained pots. Thus the same trees will produce fruit in the same-sized pots for many years.

Forcing Figs.—To secure a supply of ripe fruits by the middle of April to early in May, the trees must be grown in pots with bottom heat, and be thoroughly established, properly prepared, and duly rested, starting them by the middle of November. These trees afford a second crop of fruit about mid-June to early July, when they must be allowed to ripen their growths and go to rest, clean and unburdened with third-crop figs. Trees not previously forced early should be started in January, and grown so as to mature a good growth early, going to rest in September. Potted trees started in bottom heat during January, ripen the first crop from the middle of May to early June, and the second crop about mid-July to early August, and after that crop is gathered the trees must be kept free of third-crop figs, and mature the growths. Where other trees are grown in pots, and they are brought on gently from March, they will ripen a first crop about the end of July or early August, and will continue to afford luscious figs until November, if early, mid-season, and late varieties are grown; they should then go to rest, merely excluding frost, during the winter.

Border trees are not wisely started before the new year, and they will then ripen the first crop towards the end of May, continuing into July; the second crop closely following, and fine fruits are produced up to October. Other trees started about the middle of February ripen their first crops about mid-July, the second crop commencing to ripen about six weeks afterwards, and keep on until October or November. If border trees are assisted with fire heat after they break naturally in March or early April, the first crop ripens in early August, and the second crop from

mid-September to nigh Christmas. The potted trees usually consist of early and sure first-cropping varieties, when forced; but border trees are of the larger kinds, and give fruit far more successionally in their second crops. Each cultivator must select those varieties and that mode of culture best calculated to meet requirements. Two houses afford ripe fruit from the middle of April to November, and that by reliance on few varieties; indeed, some growers only grow Brown Turkey, and maintain a supply from May to October inclusive, but more are generally grown from the selections on page 174. Structures suitable for forcing figs in borders are shown on page 189, and Fig. 62, next page, represents a house for forcing trees in pots.

ROUTINE OPERATIONS.

A concise narrative of practice in time-table order will be of great service to learners, and helpful to general cultivators.

First Week in October.—When early potted trees have cast their leaves they should be pruned, well washed, re-staked, and tied. Re-potting is best done earlier, but may be done now if needed, but there must be no delay. Lift and replant trees in borders, where the growth is too strong for fruitfulness, providing thorough drainage and rough calcareous compost rammed firm. Afford trees in late houses a little heat to ripen their fruit, but withhold water.

First Week in November.—Prepare to start the trees for ripening fruit in April. Thoroughly cleanse the house, paint the woodwork if necessary, remove every particle of old material from the beds, and whitewash the walls. If the trees are in large pots, and rooted from the bottoms and over the rims, stand them on pedestals of loose bricks, and build up walls of new turf and old mortar rubbish from the base of the pedestals round each pot to the top, as shown in Fig. 62, *h*. This plan was originated by Mr. W. Coleman, Eastnor Castle Gardens, a very successful grower and forcer of fruits, whose published information in the *Gardeners' Chronicle* we desire to acknowledge, as the practice has proved sound and reliable. When forcing commences, new roots spread through the turf, which is rammed well down, top-dressings are added as roots show on the surface, water is supplied regularly, and tepid liquid manure occasionally as needed. Loose brick pillars are useful for standing smaller pots on, preventing their sinking with the fermenting material. The fermenting materials may consist of three parts oak, Spanish chestnut, or beech leaves, and one part fresh stable manure, well worked and sweetened before using, for filling up the pits.

Third Week in November.—Place the fermenting materials in the pits loosely, and see that the heat does not exceed 70° or 75° at the base of the pots. Close the house; maintain a night temperature of 50° to 55° in mild weather, 5° less in severe, rising 10° by day, admitting a little air at the top of the house to effect a change of air. Syringe the trees twice a day, morning and afternoon, with tepid water, and damp the paths before dark. Bring the soil into a thoroughly moist state by repeated waterings.

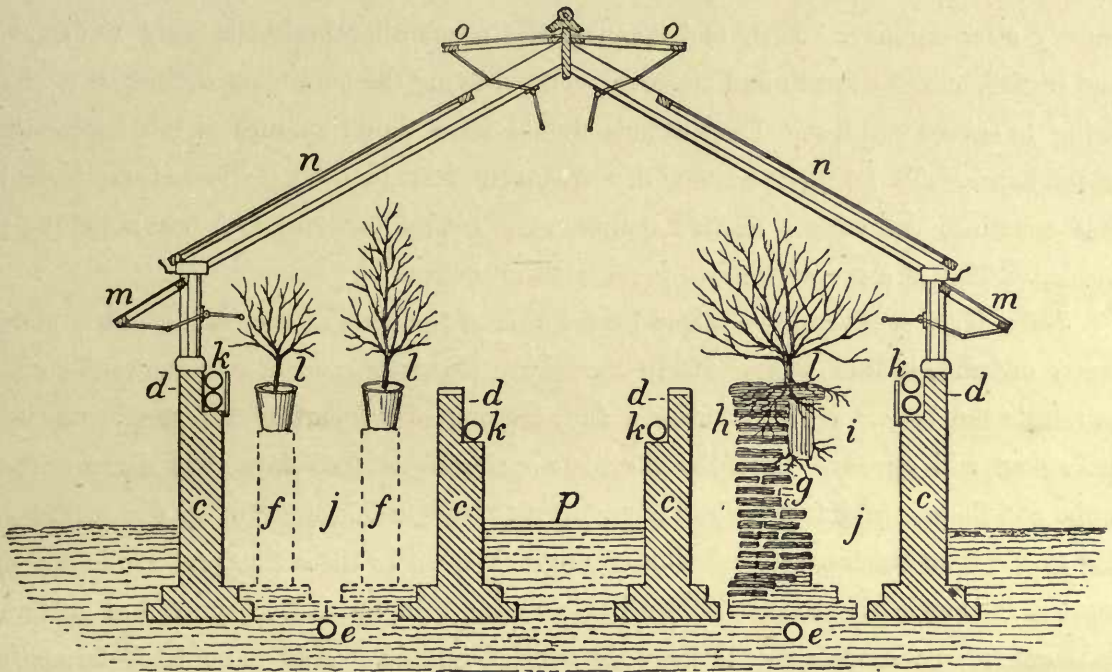


Fig. 62. SPAN-ROOF FIG HOUSE (section through K 2; ground plan, page 71, Vol. I.) FOR EARLY FORCING.

(Scale: $\frac{1}{4}$ inch = 1 foot.)

References :—*c*, 9-inch walls; *d*, $4\frac{1}{2}$ -inch walls built in cement; *e*, drains; *f*, 9-inch loose brick pillars to stand pots on; *g*, brick pedestal, against which turves *h* are built, and the roots of the tree laid-in on one side; *i*, without turf wall, showing roots; *j*, pits for fermenting materials; *k*, 4-inch hot-water pipes; *l*, fig trees in pots; *m*, side-lights open; *n*, roof-lights moveable; *o*, top-lights open; *p*, pathway.

Second Week in December.—Examine the fermenting materials placed loosely around the pots, and if it has declined to 70° press down, and place more on the surface. Continue the night temperature at 50° to 55° , turning on the heat in the morning to raise and maintain a temperature of 65° through the day, with 5° or 10° advance from sun heat.

First Week in January.—November-started trees having pushed the terminal buds, raise the night temperature to 55° to 60° , ventilate a little at 70° on fine mornings, and close early to increase to 80° , and do not allow the bottom heat to exceed 70° to 75° .

Syringe the trees twice a day in fine weather ; if dull, omit the afternoon syringing, damping the paths towards evening instead. Keep the glass clean.

Start the succession house ; if fermenting materials can be introduced in a ridge, it will save fire heat. Thin out the wood in late houses, complete the dressing of the trees, and keep them cool, merely excluding frost.

Fourth Week in January.—Continue the temperatures before advised if the weather be cold, taking advantage of gleams of sun to effect a change of atmosphere and close shortly after midday. This, and keeping the fermenting materials duly replenished and turned, affords warmth and moisture, counteracting the pernicious influences of sharp firing in severe weather. Trees in pots should have liquid manure at the temperature of the house. To let them become dry causes the fruit to drop. Planted-out trees are less exacting, yet with a limited rooting area, liberal watering and free mulching are needed. This is a proper time to plant trees in houses.

Third Week in February.—Place turves around the rims of the pots of early started trees, or bands of lead or zinc inside the rims, top-dress, and give water sufficient to penetrate the balls. Syringe twice a day, wetting every part of the trees, otherwise red spider will appear. Omit the afternoon syringing on dull days, but damp the bed, walls and floors. Maintain a night temperature of 60° to 65°, and 70° by day artificially, 80° to 85° from sun heat after closing, giving a little air in the earlier part of the day, and more as the sun heat increases. Stop all side shoots, thin out useless spray, but let terminals extend, as cropping will keep them short jointed. Add more fresh fermenting material, but do not turn the bed if the roots have entered it. In succession houses make the best of solar heat, only increasing the night temperature slightly ; otherwise proceed as for potted trees. Disbud, but let the shoots approach the glass before tying down. Start late houses, closing early with sun heat.

Second Week in March.—This is the most critical time with early forced trees in pots, the fruit remaining apparently stationary, and steadiness all round is important. Temperature 60° to 65° at night, 5° less in severe weather, 70° by day, gaining 10° to 15° from sun heat at closing, with abundance of moisture. Syringe as before, and supply weak tepid liquid manure as needed. In succession houses disbud and thin, stopping shoots to four or five leaves for spurs to produce second-crop fruit. Syringe the trees twice a day, keeping the mulching damped with liquid manure.

First Week in April.—Early varieties in pots now show signs of ripening, freer ventilation is necessary without giving a check, and every ray of light should be centred on

the fruit. This is admitted by thinning, stopping, and tying down the shoots, and it is equally important that the foliage be clean, otherwise red spider will flourish and ruin the second crop. Brown scale may appear also, and the first attacks should be promptly met with an insecticide applied with a brush. Night temperature 60° to 65° , with a chink for air; ventilate at 70° , increase the air at 80° , and damp floors and walls to sustain the foliage in health. Border trees started at the new year need syringing twice a day, and the mulching ought to be kept moist. Night temperature 60° , 5° less on cold nights; 65° to 70° by day, ventilating at the last figure; close early in the afternoon at 80° .

Fourth Week in April.—Large-fruited varieties, such as White Marseilles and Brown Turkey, now ripening in the early forced house, will require increased ventilation, but less moisture, supplying water to the roots only in a tepid state, keeping the paths and borders regularly damped. Secure a circulation of warm air by the requisite heating of the hot-water pipes, and tie those growths aside that prevent light reaching the fruits, stopping or removing side growths. In the succession house thin and regulate the growths. Also thin the fruits if the crop is too heavy for ripening. Syringe in the morning, and at closing time in the afternoon with sun heat of 85° or 90° . Feed the roots either with liquid manure, or water through a good mulching.

Third Week in May.—Continue the treatment last advised to early forced pot trees, but should red spider appear, sponge the affected parts carefully with soapy water, forcibly syringing with clear water after picking the fruit close. The trees in the succession house started with the year will be swelling their fruits for ripening, and must be fed liberally. Apply moisture to the border, walls, and paths, but not to the fruit, when it commences ripening. A dry atmosphere stunts the growths and rusts the second-crop figs.

Second Week in June.—The second crop on November-started pot trees will be advanced in swelling, the earliest varieties ripening. The growths are often studded with fruits in various stages of swelling. These must be reduced, leaving those nearest the base of the shoots, removing those near the points. Feed liberally, syringe copiously, and the ammonia combined with the water will keep the foliage clean and healthy. Attend to early ventilation in all stages of growth—never neglecting this, but allow the temperature to rise with the increased sun heat to 80° , securing that heat to 85° through the day, closing in time for the sun to raise the temperature to 90° or more. Tie down the growths before the crop begins to ripen, pinching vigorous growths to concentrate the forces on the fruit.

First Week in July.—The autumn-started trees will soon be cleared of the second-crop figs, and, though they must be kept clean, forcing should cease, otherwise they

will bear a third crop. Cease pinching, let the young growths face the light, ventilate freely, use fire heat only to prevent the temperature falling below 60°; gradually inure the trees to bear full exposure by increasing the ventilation, and take off the roof lights in hot weather. This prevents the embryo figs getting too forward, and the trees set as many fig-buds as they contain leaves for securing a full first crop after a proper season of rest. Trees planted out in succession houses ought to have the points of the shoots near the glass, and stopping should cease on the earliest started, in view of securing a full first crop another year. Directly the first crop is finished, thin the second crop liberally, syringe forcibly, and otherwise treat in swelling and ripening as the first crop.

Fourth Week in July.—Ventilate the earliest forced house of potted trees day and night, remove the roof lights on showery days, thunder rain having a wonderful effect in subduing red spider. Remove any figs advanced beyond the bud. Portable trees may be stood outside in a warm situation, but those intended for early forcing for the first time should have the roots cut off by degrees from the fermenting material, and have the wood thoroughly ripe before plunging in ashes outdoors.

Second Week in August.—When the points of the young shoots are properly ripened syringe forcibly to eject red spider, removing scale with a brush dipped in a soft-soap solution, 3 ounces to a gallon of tepid water. Planted-out trees started early in the year require careful treatment as the nights are getting colder and more damp, and ripening figs need full exposure to light, with a free circulation of warm dry air. Supply water in the morning, for there must not be any check through deficiency of nourishment, and ventilate liberally, affording sufficient air and warmth to prevent moisture condensing on the fruit or it will be spoiled. When the fruit is gathered, cut out the branches which have reached the extremity of the trellis and elsewhere, so as to give the successional growths more room, and let them grow up to the light, close tying down not favouring the maturity of the points on which the first-crop figs next season are borne.

Second Week in September.—November-started pot trees having the run of a fermenting bed may persist in growing; such should have the roots cut through about a foot from the pots, taking away the material thus detached. This will check further growth. Smaller trees that require shifting into larger pots ought to be attended to. Remove all unripe fruits, and when the leaves fall, thoroughly cleanse the trees, taking care not to injure the embryo figs, for, however slightly damaged, they will show it later in the fruits. In succession houses useful figs may be produced some time longer and of

excellent quality by a gentle warmth, and a free circulation of air, particularly at night. Trees, however, required to furnish a full first crop ought to be allowed to go to rest, thinning out any useless spray and growths no longer required. Trees started early in spring should go to rest in October. All fig trees need a resting period of not less than two months' duration.

DISEASES OF THE FIG.

No fruit is so healthy as the fig, yet canker may afflict the tree, and spot infect the fruits.

Canker.—This malady is restricted to trees grown in close, moist structures where the sun's warmth is too much confined with a view to dispense with fire-heat, the moisture excessive, and the growths too closely pinched. The disease is rarely seen in trees outdoors, in cool houses, or in early and judiciously ventilated structures. Like canker in apple and pear trees, the fig canker affects some varieties more than others, a few twigs only in some cases dying off, whilst in others the trees almost collapse. Sometimes the wounds do not encircle the branch, the scar healing over. The disease is induced through weakness of the epidermal tissue, with a morbid condition of the sap, and a fungus takes possession of the wounds. Trees afflicted with the disease outgrow it when the roots have the run of a bed of leaves, from which they may obtain nitrate of potash, and old mortar rubbish, from which they extract nitrate of lime. Potash salts for weakly and soda salts for gross trees are suitable applications for the roots. All cankered parts should be cut off and burned, unless the branches infested are large, when the canker may be cut out and the wound dressed with shell-lac dissolved in alcohol.

Spot.—This affects the half-ripened fruits, appearing to the naked eye as a raised pale salmon-coloured spot, at, or near, the eye of the fig, encircled by a depressed, discoloured band. The disease is caused by a fungus, *Glæosporium læticolor* (see "Peach Diseases"), and is most prevalent inland, where the trees are grown in heavy soil, in low, damp localities, and in ill-ventilated structures, where moisture condenses on the fruit. There is no remedy, but the disease may be prevented spreading by plucking infected fruits and burning them promptly. Keeping the fruit dry after it changes for ripening is the best preventive.

ENEMIES.

The fig grown outdoors is one of the cleanest of fruit trees, but under glass red spider and brown scale are almost unavoidable. Thrips and mealy-bug are at times troublesome, but the first is easily subdued by syringing, and the last destroyed with

spirits of wine applied with a small brush, and on ripe wood with a little diluted petroleum. Houses infested with mealy-bug must be thoroughly cleansed (see "Grape Enemies").

Special reference has been made to red spider in treating on cultural matters; therefore, it is only necessary to add here that syringing is the preventive and the remedy for red spider on fig trees. Insecticides must not be used over the fruits; and when syringing cannot be practised, infested parts should be sponged with a soft-soap solution, 2 ounces to the gallon of water. Brown scale, which first appears on the wood, must be prevented spreading to the leaves by the timely application with a brush of soft-soap solution, 3 or 4 ounces to a gallon of water. The trees must also be dressed after the leaves fall, using the soft-soap solution and a tablespoonful of petroleum, first washing the trees with warm soapy water with a brush, then following with the mixture, applying it carefully, so as not to injure the embryo figs. It is good as a winter dressing against all insects.

Fig Scale.—This differs little from ordinary brown scale; but it is smaller, and spreads with great rapidity. It belongs to the same genus as Apple Mussel Scale, and is named *Mytilaspis ficus*. Early treatment with resin compound, Vol. I., page 261, is a sure remedy, but if the scale is allowed to spread over the leaves it is difficult to eradicate without injuring the trees. Pay particular attention to early winter dressing, and thus fortify the trees against the attacks of their enemies.

GOOSEBERRIES.

THE Wild Gooseberry (*Ribes grossularia*) is a small spreading shrub, with one to three spines under the leaf-buds, and is a native of Siberia and the north of Europe, including many parts of Britain. It grows wild among ruins and in woods, and produces small red fruits. Its cultivation in this country is mentioned by Tusser (1580), and it is extensively cultivated at the present time for home use and the supply of the markets. The fruit is the earliest of the season for cooking in pies and puddings, bottling, or preserving when green; when ripe it affords a supply for dessert from July to September inclusive, makes excellent jam, also wine little inferior to champagne, and capital vinegar. The gooseberry is highly esteemed by all classes, and the crop is one of the most valuable and remunerative of bush fruits.

VARIETIES.

There are a great number of sorts in cultivation; the small or medium in size of berry, as a rule, possess the highest flavour, yet there are exceptions, and some of the kinds produce large and delicious fruit. Red gooseberries contain the most acid, but some are very sweet and valuable for late keeping; white varieties vary considerably in quality; green sorts differ materially: some have thick skins and poor pulp, others are thin-skinned, with sweet or even rich juice; and yellow varieties range from the lowest to the highest in flavour.

I.—VARIETIES WITH SMALL AND MEDIUM-SIZED BERRIES.

RED VARIETIES.

- KEENS' SEEDLING.**—Fruit medium, oblong; skin bright brownish red, very hairy; growth pendulous, earlier than Red Warrington, and a great bearer.
- RED CHAMPAGNE** (Ironmonger of Scotland).—Fruit small, roundish oblong; skin light red, hairy; bush very upright, and a capital bearer.
- RED WARRINGTON.**—Fruit medium, roundish oblong; skin red, hairy; late, the fruit hanging better than any other in the autumn. One of the best gooseberries for general cultivation, especially for ripe berries; bush pendulous, and a good bearer.

ROUGH RED (Old Scotch Red).—Fruit small, round; skin red, hairy; early, excellent flavour, and esteemed for preserving; bush erect, spreading, and a free bearer.

TURKEY RED (Smooth Red).—Fruit small, obovate; skin dark red, smooth; late, keeps well; bush semi-erect, spreading, and a good bearer.

WHITE VARIETIES.

BRIGHT VENUS.—Fruit medium, obovate; skin white, with a distinct bloom, slightly hairy; hangs well; bush semi-erect, and a free bearer.

EARLY WHITE.—Fruit medium, roundish oblong ; skin yellowish white, transparent, slightly downy ; early, and first-rate ; bush erect, spreading, and an abundant bearer.

WHITE CHAMPAGNE.—Fruit small, roundish oblong ; skin white, hairy ; bush upright, and a free bearer.

GREEN VARIETIES.

GREEN GASCOIGNE (Early Green Hairy, Green Gage).—Fruit small, round ; skin dark green, hairy ; early and good ; bush erect, and an abundant bearer.

HEBBURN PROLIFIC.—Fruit medium, roundish ; skin dull green, rather thick, hairy ; bush erect, and a great bearer.

PITMASTON GREEN GAGE.—Fruit small, obovate ; skin green, smooth ; hangs well ; bush erect, and a free bearer.

YELLOW VARIETIES.

EARLY SULPHUR.—Fruit medium, roundish oblong ; skin bright yellow, hairy ; very early, second-rate quality ; bush erect, and, when not very closely pruned, a great bearer.

RUMBULLION (Yellow Globe, Round Yellow).—Fruit small, roundish ; skin pale yellow ; early, second-rate quality ; an esteemed variety for bottling ; bush erect, and a free bearer.

SULPHUR (Rough Yellow).—Fruit small, roundish ; skin yellow, hairy ; rather late ; bush erect, and an average bearer.

YELLOW BALL.—Fruit medium, roundish ; skin yellow, smooth ; bush erect, and fairly productive.

YELLOW CHAMPAGNE (Hairy Amber).—Fruit small, roundish ; skin yellow, hairy ; late ; bush erect, and a good bearer.

SELECTIONS OF SMALL AND MEDIUM-SIZED GOOSEBERRIES NAMED IN ORDER OF SUCCESSION.

SMALL BERRIES.	MEDIUM-SIZED BERRIES.	FOR SPECIAL PURPOSES.
<i>Six for quality.</i>	<i>Six for quality.</i>	<i>Earliness.</i>
Green Gascoigne.	Early White.	Early Sulphur.
Red Champagne.	Keens' Seedling.	<i>Lateness.</i>
White Champagne.	Yellow Ball.	Red Warrington.
Pitmaston Green Gage.	Hebburn Prolific.	<i>Preserving.</i>
Turkey Red.	Bright Venus.	Rough Red.
Yellow Champagne.	Red Warrington.	Red Champagne.
<i>Three for quality.</i>	<i>Three for quality.</i>	Red Warrington.
Red Champagne.	Keens' Seedling.	<i>Bottling.</i>
Pitmaston Green Gage.	Bright Venus.	Rumbullion.
Yellow Champagne.	Red Warrington.	<i>Wine.</i>
<i>One for quality.</i>	<i>One for quality.</i>	Yellow Champagne.
Red Champagne.	Keens' Seedling.	

II.—VARIETIES THAT PRODUCE LARGE FRUIT OF GOOD QUALITY.

RED VARIETIES.

COMPANION.—Fruit rather flat, rounded at the ends ; skin light red, hairy ; early, and of excellent quality ; bush spreading, and a free bearer.

CROWN BOB.—Fruit oblong ; skin bright red, hairy ; quality first-rate ; bush pendulous, and bears freely. An old and popular variety.

FARMER'S GLORY.—Fruit obovate, skin dark red, mingled with green, thick, downy ; early ; bush pendulous ; an abundant bearer.

FORESTER.—Fruit short, plump ; skin bright red, hairy ; early, and of good quality ; bush erect, large, and a free bearer.

INDUSTRY (Whinham's).—Fruit roundish oblong ; skin dark red, hairy ; bush erect, spreading, large, and very productive. One of the best for marketing.

LANCASHIRE LAD.—Fruit roundish ; skin dark red, hairy ; bush erect, spreading, large, and an abundant bearer. Much grown for market.

LION'S PROVIDER.—Fruit long ; skin light red, pinkish, rather hairy ; beautiful, and of first-rate quality ; bush erect, spreading, and a free bearer.

MONARCH.—Fruit oblong, plump ; skin bright dark red, hairy ; bush erect, large, and a good bearer.

PLOUGH BOY.—Fruit long ; skin bright light red, shaded yellow, smooth ; handsome, quality excellent, and late ; bush spreading, slender, and free bearing.

RIFLEMAN.—Fruit roundish ; skin red, hairy ; quality first-rate, late, and good ; bush erect, and produces freely.

SPEEDWELL.—Fruit oblong, plump ; skin light red, hairy ; early, and excellent ; bush erect, large, and bears profusely.

YAXLEY HERO.—Fruit obovate ; skin red, hairy ; bush erect, and an abundant bearer.

WHITE VARIETIES.

ANTAGONIST.—Fruit long, plump ; skin creamy white, hairy ; handsome, and of good quality ; first-class either green or ripe ; bush spreading, large, and very prolific.

CARELESS.—Fruit long ; skin creamy white ; handsome ; bush spreading, slender ; an abundant bearer.

DUCHESS OF SUTHERLAND.—Fruit oval, long ; skin creamy white, smooth, or slightly hairy ; bush spreading, medium-sized, and a free bearer.

LADY LEICESTER.—Fruit plump, shoulders broad ; skin greyish white, shaded with green, hairy ; early, and good ; bush spreading, and a free bearer.

MAYOR OF OLDHAM.—Fruit round ; skin greenish white, smooth ; quality first-rate ; bush spreading, large, and a good bearer.

PATIENCE.—Fruit long ; skin greenish white, speckled, smooth ; quality excellent ; bush semi-erect, fine, and bears freely.

QUEEN OF TRUMPS.—Fruit long, tapering ; skin greenish white, smooth ; early, and good ; bush spreading, vigorous, large. One of the best varieties for affording green or ripe berries.

SHEBA QUEEN.—Fruit obovate ; skin white, downy ; quality excellent ; bush erect, and an abundant bearer.

SNOWDROP.—Fruit roundish, plump ; skin pure white, green-veined, hairy ; beautiful, and of superior quality ; bush spreading, large, slender, and a free bearer.

WELLINGTON'S GLORY.—Fruit roundish, oblong ; skin white, downy ; bush erect, and bears freely.

WHITE LION.—Fruit obovate ; skin white, downy ; late, quality excellent ; bush pendulous, and a free bearer.

WHITESMITH.—Fruit roundish oblong ; skin white, downy ; early, and of first-rate quality ; bush erect, and an abundant bearer. One of the best for a supply of green or ripe berries.

GREEN VARIETIES.

ANGLER.—Fruit roundish ; skin green, smooth, or slightly downy ; early, and of good quality ; bush erect, and a free bearer.

GREEN OVERALL.—Fruit round ; skin deep green, smooth, with grey down ; beautiful and delicious ; bush spreading, large, and bears freely.

HEART OF OAK.—Fruit oblong, tapering ; skin green, with yellow veins ; bush pendulous, and a good bearer.

JOLLY ANGLERS.—Fruit oblong ; skin green, downy ; late, excellent ; bush erect, and a free bearer.

KEEPSAKE.—Fruit square-shouldered, nose plump ; skin green, smooth, or slightly hairy ; early, and first-rate ; bush pendulous, large, and very prolific. One of the best varieties for green or ripe berries.

LAUREL.—Fruit obovate ; skin pale green, downy ; excellent for late berries ; bush erect, and an abundant bearer.

LOFTY.—Fruit long ; skin dark green, hairy ; bush medium-sized, and a good bearer.

LORD ELDON.—Fruit round ; skin dark green, smooth ; early and good ; bush semi-erect, medium-sized, and bears profusely.

RANDOM GREEN.—Fruit roundish, plump ; skin bright green, smooth ; excellent quality, good for ripe berries ; bush spreading, and very prolific.

ROSEBERRY.—Fruit round ; skin dark green with a rose tinge, smooth ; good for cooking green, and delicious when ripe ; bush erect, large, and very productive.

THUMPER.—Fruit flat-sided, plump ; skin green, smooth ; late and excellent ; bush pendulous, and a free bearer.

THUNDER.—Fruit roundish, plump ; skin green, hairy ; early, and excellent in quality. Bush semi-erect, stout, medium sized, and prolific.

YELLOW VARIETIES.

BROOM GIRL.—Fruit square-shouldered; skin dark yellow, shaded olive, hairy; early, and excellent; bush upright, strong, large, and a free bearer.

CATHERINA.—Fruit longish, obovate, plump; skin orange yellow, slightly hairy; beautiful, and first-rate in quality; bush spreading, slender, medium sized, and a free bearer.

GIPSY QUEEN.—Fruit long; skin pale yellow, blended with white, smooth; early and delicious; bush pendulous, slender, medium sized, and a free bearer.

GUNNER.—Fruit round; skin dark olive, shaded with yellow; excellent; bush erect, strong, and an abundant bearer.

HIGH SHERIFF.—Fruit round, plump; skin orange yellow, very hairy; very good; bush pendulous, large, and a free bearer.

LEADER.—Fruit square shouldered; skin greenish yellow, covered with greyish down; early, and first-class; bush spreading, vigorous, and a free bearer.

LEVELLER.—Fruit long, tapering; skin greenish yellow, smooth; early, and excellent; bush spreading, large, and an abundant bearer.

MORETON HERO.—Fruit oval; skin pale yellow, smooth or downy; bush semi-erect, fine, and free bearing.

MOUNT PLEASANT.—Fruit long, plump; skin deep orange yellow, hairy; late, handsome, and excellent; bush spreading, strong, large, and prolific.

PERFECTION.—Fruit round; skin light yellow, a little hairy; excellent quality; bush semi-erect, slender, medium sized, and a moderate bearer.

SMILING BEAUTY.—Fruit oblong; skin yellow, smooth; early, and first-rate; bush pendulous, and a free bearer.

TWO TO ONE.—Fruit square shouldered; skin bright golden yellow, hairy; early; bush spreading, strong, and a good bearer.

SELECTIONS OF LARGE GOOSEBERRIES FOR QUALITY AND USEFULNESS IN ORDER OF RIPENING.

RED VARIETIES.

For quality.

Forester.
Yaxley Hero.
Plough Boy.

For green or ripe berries.

Industry.
Crown Bob.
Lancashire Lad.

WHITE VARIETIES.

For quality.

Sheba Queen.
Snowdrop.
White Lion.

For green or ripe berries.

Antagonist.
Queen of Trumps.
Careless.

GREEN VARIETIES.

For quality.

Green Overall.
Lofty.
Jolly Anglers.

For green or ripe berries.

Keepsake.
Roseberry.
Random Green.

YELLOW VARIETIES.

For quality.

Gipsy Queen.
Gunner.
Mount Pleasant.

TWELVE BEAUTIFUL VARIETIES.

Broom Girl.
Green Overall.
Companion.
Antagonist.
Catherina.
Lion's Provider.
Snowdrop.
Careless.
Lofty.
Leveller.
Plough Boy.
Thumper.

Three beautiful varieties.

Green Overall.
Snowdrop.
Leveller.

TWELVE USEFUL VARIETIES.

Keepsake.
Whitesmith.
Queen of Trumps.
Industry.
Antagonist.
Companion.
Lancashire Lad.
Roseberry.
Gunner.
Random Green.
Mount Pleasant.
Rifleman.

Three useful varieties

Whitesmith.
Industry.
Antagonist.

III.—LANCASHIRE PRIZE OR EXHIBITION GOOSEBERRIES.

Table of varieties, season, and weight. Dwts. (pennyweights); grs. (grains); troy.

RED VARIETIES.	Season.	Dwts.	Grs.	GREEN VARIETIES.	Season.	Dwts.	Grs.
* Beauty	late	31	6	Fearless	mid.	27	10
Clayton	mid.	32	8	General	late	27	14
*† Companion	early	31	11	Green London	mid.	27	—
Conquering Hero	mid.	31	11	*† Green Overall	mid.	27	6
* Dan's Mistake	mid.	31	—	Jerry	mid.	27	8
Dr. Hogg	mid.	29	4	* London City	mid.	30	5
* Eskender Bey	mid.	30	6	Matchless	mid.	27	18
Foreman	mid.	30	11	Plunder	mid.	29	21
* Lion's Provider	mid.	30	21	Postman	mid.	27	—
*† London	mid.	37	7	*† Shiner	mid.	31	19
Magnet	early	28	20	* Sir George Brown	mid.	29	7
*† Plough Boy	late	30	21	* Stockwell	mid.	30	18
Slaughterman	early	30	—	Surprise	mid.	27	2
Speedwell	early	29	4	*† Thumper	late	30	9
* Talfourd	late	29	8	Thunder	early	27	14
Wonderful	mid.	33	—				
				YELLOW VARIETIES.			
WHITE VARIETIES.				Broom Girl	early	28	12
*† Antagonist	mid.	34	21	Candidate	mid.	25	—
Blackley Hero	late	26	1	*† Catherina	mid.	32	8
*† Careless	mid.	31	19	Criterion	mid.	25	17
Eagle	mid.	27	12	Drill	late	32	—
Freedom	mid.	28	15	* Garibaldi	mid.	27	14
Hero of the Nile	mid.	28	—	* Gunner	mid.	28	18
Jenny Lind	early	26	18	High Sheriff	mid.	28	2
King of Trumps	mid.	26	15	Hue and Cry	mid.	27	16
* Lady Leicester	early	30	4	* Leader	early	28	14
Mitre	mid.	26	12	*† Leveller	early	30	11
Overseer	mid.	29	12	Lord Ranccliffe	mid.	28	8
Peto	mid.	26	4	*† Mount Pleasant	late	30	4
Queen of Trumps	mid.	31	—	Peru	mid.	30	—
Snowdrift	mid.	27	3	Pilot	mid.	29	6
*† Snowdrop	mid.	34	5	Railway	late	30	7
Tally-ho	mid.	26	18	Two-to-One	early	28	8

* Twenty-four Select Varieties. † Twelve Select Varieties.

The varieties named in the table are characterised by the enormous size of the berries under special culture; some are very coarse, much squared or angled, thick-skinned, and contain comparatively little pulp; many are very handsome in shape, but not of more than second-rate quality: and not a few are beautiful and delicious. The latter varieties are described in Class II., and included in the table for facility of reference as regards weight. We have decided that no useful purpose would be served by entering into details of the other varieties enumerated. The exhibition varieties are, as a

rule, free in growth, and, when not very closely pruned, free bearers; but to secure the largest berries, special culture is absolutely essential, and will receive attention.

CULTIVATION.

Propagation.—Gooseberries are increased by seeds, cuttings, layers or suckers.

Seeds are only had recourse to for the raising of new varieties, as no variety reproduces itself true from seeds, and even with cross-fertilisation the chance of originating a variety superior to the best extant is uncertain. To operate successfully in cross-fertilising the flowers, it is necessary to enclose those fertilised in a gauze bag, so as to exclude bees and other insects. Very little, however, has been done in cross-fertilising the gooseberry. The usual practice is to collect seed from the finest fruits of the choicest varieties when dead ripe, drying them, and sowing in the open ground or in pots or pans under glass. By the latter practice the seeds vegetate sooner, and if the plants are advanced in pots before planting a year may be gained in fruiting.

Layering may be pursued in summer, merely pegging the tops of the branches down, and covering them with light soil, or larger branches may be thus rooted and removed to permanent quarters the same season; but this method is not the way to secure symmetrical bushes, and is only useful to continue scarce varieties.

Suckers seldom make good bushes, and are objectionable from their proneness to push growths from the base; this is not easily preventable, as it is difficult to remove all the eyes from the part covered with soil.

Cuttings are much the best, selecting strong well-ripened shoots, taking them off where the base is solidified. The ends should be cut transversely immediately below a joint, the tops shortened so as to make the cuttings 10 to 12 inches long, all eyes and spines removed to a height of 6 inches from the base, leaving three or four good buds at the upper part to form branches. Early autumn is the best time for inserting the cuttings in rich free soil and an open situation, placing them in trenches 4 inches deep, and treading the soil against them. The cuttings should be placed 6 inches apart in the rows, and the rows 1 foot asunder, leaving out every fifth row for facility of weeding. By inserting the cuttings early in autumn they form a callus and push growth strongly in spring, forming plants by the following autumn, but cuttings may be inserted during the winter, or early in spring. Nurserymen in raising large numbers bed the cuttings in up to the top buds; they root during the summer and are transplanted with the roots about 3 inches deep in the autumn. It is also a very good plan for inexperienced amateurs.

Situation.—An open site is imperative to secure the fullest crops of the best-flavoured fruit, but shelter from north and east winds renders the crop less liable to suffer from spring frosts. The fruit does not attain the highest perfection in hot and dry situations without recourse to mulching and watering in dry weather. Moist sites suit the gooseberry provided the ground is freed of superfluous water by natural or artificial drainage. Southern exposures are desirable in the north, as early fruit is the most valuable. Northern aspects answer when not bleak, and in hot and dry localities are preferable, as the fruit is more shielded from hot sunshine, which tends to prematurely ripen it in the southern counties. Apart from these considerations open, sunny situations are requisite to produce the essentially British gooseberry in perfection.

Soil.—The gooseberry has not changed since Tusser's time in its liking for a "rotteny mould"—alluvial; any good soil sufficiently loose and permeable for its roots, with sufficient humus to keep it moist. Light, shallow, gravelly soils do not suit gooseberries, and strong clays that bake and crack in hot dry weather are practically useless. A good loamy soil is unquestionably the best, as it is not so expensive to prepare for planting as stiff soil, nor so exacting in after needs as light soil, and it returns the best profits. The soil ought not to be less than 12 inches deep, and below that a similar depth of fairly good loosened mould. The gooseberry is a shallow rooting bush, yet a good depth of soil is requisite to hold moisture and nutriment. In trenching or digging the ground the good soil should be kept at the top, mixing the manure, if any is applied, with the upper 6 inches. Add lightening materials with heavy soil, and render light soil more retentive by loam of a stronger nature and cow manure incorporated through it, seeking in all a rich permeable staple.

Arrangement.—In most parts of the country and for general purposes the bush form is the best. The bushes may be placed in rows 6 feet asunder where the soil is rich, and 5 feet in ordinary soil. Compact growers may be accommodated in rows 4 feet apart. As a rule, gooseberries are placed much too close together for full development, and too far apart for early productiveness. Temporary bushes may be grown between the permanent ones for a few years, the former to be transplanted when the latter require the whole space; there is then no waste of ground, whilst the ultimate results are more satisfactory. The bushes are best arranged in "opposite vacancy" order, and with the rows running north and south.

Pyramids at 6 feet apart and standards between them are interesting and useful in borders along the sides of walls in gardens.

The gooseberry succeeds admirably trained as single or double upright cordons to wire espaliers, either by the side of walks at 1 foot from the edge, or in parallel lines 4 to 4 feet 6 inches apart, and 4 to 5 feet in height. In this way they form profitable hedges between flower and vegetable gardens, and are easily protected from frosts in spring and from birds in summer. Single cordons may be planted 9 to 12 inches, and double cordons 18 inches to 2 feet apart. The greater distance is the most satisfactory in the end, especially with the stronger-growing varieties. In the southern parts of the kingdom a fair amount of spray (summer growth) is necessary to protect the fruit from the sun's rays.

North walls answer in the south for the finer sorts, and in all parts for a late supply of fruit, but this is not equal in quality to that grown in the open. The trees may be grown as uprights with one, two, four or six branches, planting 9 to 12, 18 to 24, 36, and 54 inches apart respectively, remembering that it is better to allow the bearing wood to extend a little from the wall than to keep it very close thereto. Gooseberries may be arranged on other aspects, but except in cold and late localities they do not succeed against walls facing the south or east, a western exposure being more suitable.

Planting.—The best time to plant is in October or November, as then the roots take to the soil at once if it is well prepared, and has been moistened by autumn rains. Planting, however, may be performed any time from the leaves falling until the buds commence growing if the ground is in good working order. A little well-decayed manure, mixed with the soil in planting, facilitates root action and free growth. Avoid plants or bushes taken from market to market till all the moisture is extracted from the roots. All broken ends should be cut smooth, and the roots spread out evenly on a convex base, not planting deeper than 4 to 6 inches, and having 6 inches of clear stem above ground, firming the soil well. A forkful or two of partially decayed manure spread on the surface around the stem as far as the roots extend protects them from frost and enriches the soil.

Training.—*Open Bushes* may be trained in cup form (Vol. I., page 179), with clear stems. A bush a year old from the cutting may have three shoots, and these should be cut back to three or four buds of their base; if more than three have been produced, shorten the other to one bud. Care should be taken to prune erect-growing varieties to outside buds, and spreading growers to inside buds; pendulous varieties being always cut back to buds pointing upwards. In the following year two shoots should be encouraged from each of the three cut-back branches, and may be

pegged outwards if erect-growing after they become sufficiently set to bend, whilst the pendulous may be raised by forked sticks thrust in the ground. Any shoots that start beyond those named must be shortened in summer, and cut back to an inch of their base in the autumn to form spurs, the leading shoots being then shortened to 6 inches if weak, or to 8 inches if strong, observing to cut to outside or inside buds as the bushes are erect or spreading.

The third year each leading shoot of the preceding season will produce two leading shoots—twelve to each bush, which form the requisite number of branches for an ordinary bush, and these ought to be evenly disposed around the stem.

Though a cup-shaped bush is the orthodox method of training the gooseberry, and found to answer in northern locations, in the southern districts of England it is

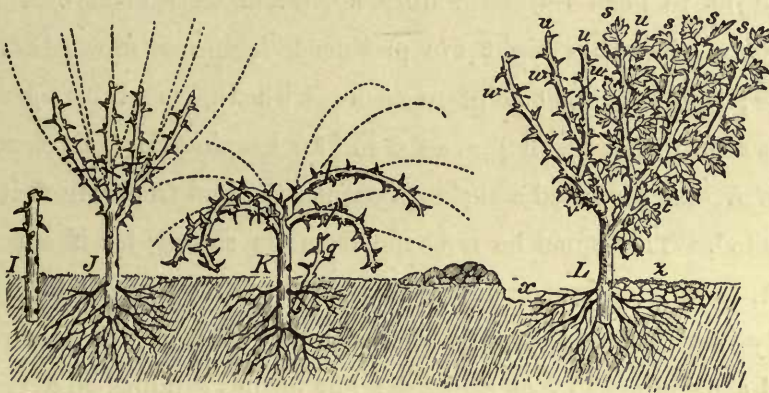


Fig. 63. ERECT AND PENDULOUS GOOSEBERRY BUSHES.

References :—*I*, cutting prepared and inserted in the ground. *J*, erect-growing bush in the autumn of the first year from the cutting, showing bars for pruning to outside buds ; dotted lines—growths in the year following. *K*, pendulous bush, one year from the cutting : bars for shortening to upper buds ; dotted lines—growths in second year ; *g*, sucker properly detached from the socket ; *r*, sucker cut wrongly at the dotted bar. *L*, erect bush in the second year : *s*, branches in growth ; *t*, side shoot pinched ; *u*, branches in autumn ; *v*, point of shortening pinched side shoot ; *w*, point of pruning branches to outside buds ; *x*, soil removed from the roots ; *y*, rich compost or manure placed in the opening ; *z*, fresh soil placed on winter dressing.

considered desirable to have the centre of the bush closer, as this prevents the sun scorching the fruit ; but it is necessary everywhere to have the branches so far apart as to admit the hand between them, alike for facilitating gathering and to allow light and air to penetrate to the base of the branches so as to insure the most and finest fruits. The simpler mode of training alluded to is merely the cup-shaped bush with the centre filled in, the cuttings being prepared and inserted in precisely the same manner as described on page 206, and illustrated page 99, Vol. I. As this system is the one most generally practised an illustration will be of service to the uninitiated.

In a year from inserting the cutting, Fig. 63, *I*, a well-rooted bush with four or more branches will be produced, as represented in *J*. If the variety be erect-growing the four branches are to be shortened 6 inches from the base to outside buds. If the bush have more than four branches, select that number of the strongest and best situated for shortening to originate more branches, cutting the others to within an inch of their origin. Shortening the four branches to the bars, as shown in *J*, has the effect of doubling them in the next season, as indicated by the dotted lines. This is essential with erect-growing varieties, but those having pendulous growths need shortening to buds pointing upwards, as shown by the bars in *K*, for the growths that follow will be in the direction in which the buds point. If the buds point inwards the bush becomes crowded in the centre; if pointing downwards, the branches are formed too low; and the aim should be to keep the bush duly open and well clear of the ground. By shortening the four branches eight are produced, inclining upwards, as indicated by the dotted lines; this is a great point to secure with the pendulous-growing varieties, as the branches require to be well above the soil for keeping the fruit clean and admitting air. The bush, *K*, has produced a sucker, because the bud from which it proceeded had not been extracted. This must be removed from its socket, for if cut off, and one or more buds left, it will spring again, giving further trouble. A bush of an upright-growing variety in the second year is shown in *L*. The branches of recently planted trees will need shortening to 7 or 8 inches; but bushes established a year only need to have 2 or 3 inches cut off the weak ends of upright, or the curved tips of pendulous growers. One foot, however, is a maximum length to leave; therefore, shorten growths that exceed a foot to that length in the autumn. During summer pinch any laterals or side-shoots not required to 3 inches (*t*), and cut close in autumn (*v*). The bush treated as advised will produce fruit freely in the third year, especially if the soil be removed from the stem outwards down to the roots (*x*), supplying rich compost in its place (*y*), covering it with a little fresh soil taken from the open spaces, exchanging it for that removed. This is a capital plan for keeping gooseberries in health and fruitfulness, the loose surface (*z*) admitting air and rain freely, whilst the roots are fed with sweet food.

The Lancashire System.—This is followed by those excelling in the production of large gooseberries for prizes, and consists in transplanting one-year-old bushes with three shoots only, bringing these down to nearly a horizontal position with hooked sticks when they grow erect, and raising the pendulous with forked ones. Unless more than

a foot in length, or weak at the ends and unripe, the branches are not shortened; but if pruning is considered desirable it is confined to shortening them to firm wood and proper buds, that is, buds on the under side of erect and the upper side of the branches of pendulous varieties. The three branches produce a number of side-shoots in the following summer, most of which are cut back to one eye in autumn, and the others to about half their length, but only where there is room for them, as the fewer the shoots the larger will be the fruit. The tree in the autumn after planting is pruned so as to consist of three primary branches, each with two young shoots, these being shortened to 7 or 8 inches. In the following year the two branches on each primary have two shoots each left at the winter pruning, and these are shortened to about 7 inches, cutting off all others closely. The bush now consists of three primaries, forked twice, or twelve branches altogether, spread out (as near as may be) flat, and about 1 foot from the ground. These branches are a good distance apart. The marvellous fruits grown in Lancashire, Cheshire, and neighbouring counties are the produce of young shoots of the previous year, for the younger the tree, and the less crowded with wood, the larger and finer the fruit. Besides this, there is an all-round special system of culture, namely: the one-year-old three-branched bush is planted in prepared soil—sound loam, preferably marly, deeply stirred, sweetened and enriched with partially decayed stable manure, adding fresh, turfy loam to old garden soil, and always covering the roots with sweet, aerated mould. In the growing season attention is strictly given to watering and feeding the roots, and saucers full of water are placed under the fruits, almost or quite touching them, to supply the limited number retained with moisture. This is called “suckling” by the Lancashire growers and, combined with keeping the growths thin, insures the perfect swelling of the severely thinned berries. Every two or three years the roots are uncovered in autumn, and the strongest cut back nearly one-half of their length, laying them in, and covering with fresh marly loam, which so invigorates the trees by the increased number of active feeders as to produce fruit of superlative excellence.

Upright Training for Espaliers, Fences or Walls.—The trees for these purposes should be one year from the cutting, clean, healthy, and strong with a clear stem 6 inches or more in height. If intended for a single cordon select the most upright and strongest shoot, shorten it to 1 foot from its base, securing the part retained to the support perfectly upright, and cut the other shoots to within an inch of their origin. The following year the leader will push several growths; train the best one as leader, and if any laterals are produced from it pinch them to one leaf, shortening them to within an inch of the

base in autumn, and the leader to 1 foot. Pinch off the points of all side shoots after they have made four good leaves. This plumps the basal buds without starting them into growth, and if cut back to an inch in autumn ample buds are left for producing fruit the following year. This is termed "spurring in." Naturally formed spurs are short stubby growths studded with leaves and buds at their axils; these are neither pinched in summer nor shortened in winter. Continue the practice described until the branches reach the limits, then all growths are manipulated as directed for side shoots. The leading growths may first be secured to upright stakes, and eventually to cross wires fixed to posts, or an iron-and-wire espalier may be erected at the commencement, and straight pieces of wire fixed vertically across the wires where the cordons may be desired. No. 8 galvanised wire answers well, and need only be temporary, the wire coming in useful for other purposes. A little illustration will make the foregoing clear to novices.

To form a triple cordon the central branch *a* in the tree *M*, or *p* in the tree *O*, Fig. 64 opposite is shortened two-thirds its length, and the side branches *c* about one-third, so that the three branches are nearly equal in height. The central branch is the strongest, and will continue so afterwards through the sap flowing most freely in upright channels.

If a tree with four vertical branches be desired, two branches only are retained, as in forming the double cordon, and, if sufficiently long, they are shortened to $13\frac{1}{2}$ inches, taking a shoot from each extremity and at $4\frac{1}{2}$ inches on each side of the stem in the following year, rubbing off the rest, training the growths upright to form the four branches at 9 inches apart. If the side branches are less than $13\frac{1}{2}$ inches long, shorten them to lower or upper buds as the variety is erect or pendulous, bringing them into a horizontal position, as near as may be without breaking, and in the following year reserve growths only from the extremities and at $4\frac{1}{2}$ inches on each side of the stem, pinching the latter when 4 inches long, cutting them back in autumn to a well-situated bud at their base, training the extremity growths their full length, and shortening them to an upper bud in autumn $13\frac{1}{2}$ inches from the stem. The following summer a growth is taken upright from each extremity of the horizontals and one from each spur on opposite sides of the stem, rubbing off the rest. Thus the tree has four branches ultimately. Should a tree with six branches be required, the horizontals are shortened to $22\frac{1}{2}$ inches in the autumn of the second year from the cutting, then treated as above described. Single cordons (*M*, *N*,) cover a given space in the shortest time, and are very easy to manage.

When the branches are worn out a young shoot should be encouraged near the base, and when the fruit is gathered the old branch may be cut out, training the fresh one in its place. This is easy when the branches are 9 inches apart, but if only 6 inches asunder the leaves shade their neighbours too much, the growth is weak, and the fruit small and indifferent in flavour. High training is not suitable for gooseberries. They do admirably up to 6 feet. If above that height, though the branches may bear well, they are apt to become deficient of wood at the base.

Standards.—Gooseberries are sometimes trained with round heads on tall stems. The pendulous varieties form handsome heads, and produce grand fruits if grafted on

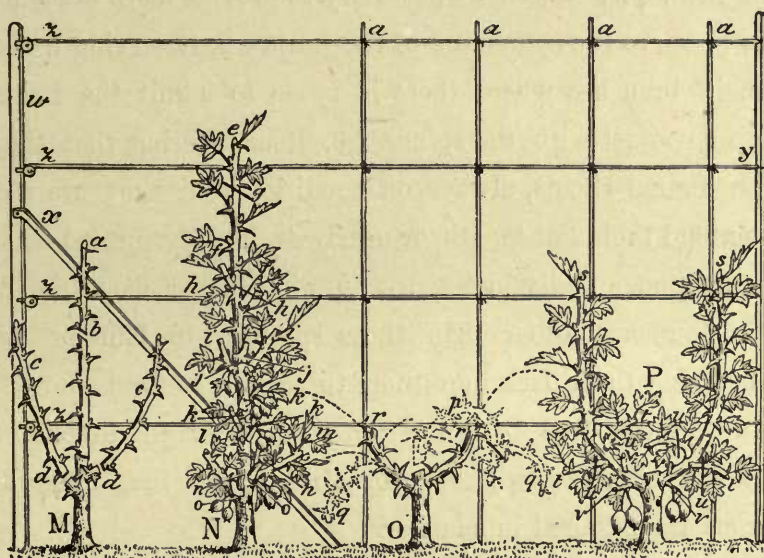


Fig. 64. SINGLE AND DOUBLE VERTICAL CORDON GOOSEBERRY TRAINING.

References :—*M*, erect-growing one-year-old plant, showing pruning for single cordon : *a*, leader ; *b*, point of shortening leader ; *c*, shoots to be shortened to within 1 inch of their bases (*d*) to form spurs. *N*, single cordon in first year's training, representing summer and winter pruning : *e*, leader ; *f*, laterals pinched at one leaf ; *g*, point of shortening leader in winter ; *h*, point of winter pruning laterals ; *i*, side shoots pinched ; *j*, point of winter pruning side shoots ; *k*, natural spurs ; *l*, pinched growth from cut-back branch ; *m*, growth pinched and pushing laterals without starting the basal buds ; *n*, point of shortening growths from cut-back branches in winter ; *o*, spurs formed by shortening branches to 1 inch of their base. *O*, one-year-old pendulous bush ; *p*, centre branch to be cut away ; *q*, side branches nearly on a level to be shortened to the bars ; *r*, cordons brought upright after shortening—dotted lines indicate direction of growths the following season. *P*, pendulous variety in first year's training for double cordon : *s*, leaders ; *t*, side shoots pinched ; *u*, points of winter pruning side shoots ; *v*, natural spurs ; *w*, straining pillar with winders ; *x*, stay ; *y*, standard ; *z*, wires (No. 13 I.W.G.), 1 foot apart in height ; *a*, temporary vertical wires.

strong upright-growing varieties about 4 feet in height. These are raised in the same way as standard currants (pp. 159-161), and then whip-grafted (page 122, Vol. I.) with the desired variety. Standard trees are very interesting to amateurs. They may be grown in sheltered situations, as in garden borders, alternately with pyramids,

formed as described for pyramidal currants (page 159). The erect-growing varieties form the best pyramids and contrast well with the pendulous varieties grown as standards.

Pruning —Intelligent pruning after the bushes are formed is absolutely essential to secure good crops of fruit. Amateurs prune too little, cottagers and farmers are afraid to use the knife; the result is stunted, tufted, thickly-set weak growths, bearing small and inferior fruit. Other growers err in the opposite direction, and by cutting back all the young shoots systematically, cause the trees to produce a thicket of luxuriant growths annually, with a modicum of gooseberries. A constant crop of useful fruit is the outcome of pruning intelligently conducted, namely:—1, Main branches thinly disposed, shortening them only as may be necessary to provide more branches in the proper direction, and to preserve the symmetry of the bush. 2, Reserving well-situated young shoots on the main branches where there is space to admit the hand between them without coming in contact with the spines. 3, Remembering that the finest fruit is produced on firm annual shoots, always on condition that they are not overcrowded. 4, Letting these extend their full length, or nearly so, in fully formed bushes, having due regard to limits, direction, and distance apart. 5, Pinching or shortening all side growths issuing from the branches, other than those specified, to four or six leaves about midsummer, and cutting them back in autumn to an inch to form spurs. 6, Cutting out worn-out branches to make room for young growths in the right direction for supplanting the old. 7, Removing branches, whether worn out or not, that overcrowd the bushes as soon as the crops are gathered in summer.

The foregoing points in pruning, rightly comprehended and correctly practised, never fail to render gooseberry trees pleasing and productive. Beginners will be assisted in summer and winter pruning by the sketches on the next page.

In *Q* (Fig. 65) is seen the principle of bearing on young wood, the formation of spurs (*b*), and the production of a young shoot (*d*). These produce fruit for gathering green by the handful at one grasp the following year, which means money gained to the grower of gooseberries for sale. The enormous crop does not exhaust the trees, because the whole or major portion of the berries are gathered young, and, when part of a crop is allowed to ripen, the green portion is removed from the weakest, heaviest-laden branches, retaining the finest berries in the best positions on the most vigorous growths. By spurring-in a shoot which has been summer pruned, finer berries are produced, as represented in *R*, but only two instead of seven, borne by an unpruned shoot, as shown in *Q*. When the object is green berries the unpruned branch has

the advantage, but when the object is large ripe berries there is no comparison between those perfected by a pruned branch, *R* 2, and those of an unpruned, *Q* 1. If gathered



Fig. 65. CHARACTERISTIC GROWTHS OF GOOSEBERRY. SUMMER AND WINTER PRUNING.

References :—*Q*, last year's shoot unpruned bearing fruit : *b*, spurs ; *c*, terminal growth ; *d*, shoot ; *e*, point of pruning in previous autumn to form spurs close to the main branch. *R*, spurs and shoot, the result of shortening *Q* to *e* : *f*, spur ; *g*, spur fruiting ; *h*, shoot pinched ; *i*, portion nipped off ; *j*, point of winter pruning. *S*, shoot not shortened : *k*, spur ; *l*, spur in fruit ; *m*, shoot ; *n*, point of shortening in summer ; *o*, point of winter pruning. *T*, erect spreading bush—back branches not shown ; *p*, worn-out primary branch in summer ; *q*, point of cutting it out after gathering the fruit ; *r*, subsidiary branches in fruit ; *s*, side shoots shortened ; *t*, terminal shoots topped ; *u*, successional base growths to supplant worn-out branches ; *v*, branches with side growths shortened ; *w*, branch with all summer shoots ; *x*, branch with all summer shoots in winter, showing waste—a crop of twigs ; *y*, point of winter pruning side shoots ; *z*, branch (summer pruned) in winter, showing small parts (detached) needing removal ; *a*, worn-out branch in winter—to be cut out at *q* ; *b*, dead spurs ; *c*, subsidiary branch left entire to supplant *a* ; *d*, subsidiary branch winter pruned ; *e*, side shoots spurred in ; *f*, spurs ; 1 and 4, unpruned branch berries ; 2 and 3, pruned branch fruits.

young the produce of the branch *Q* is three and a half times more remunerative than that of *R* ; if both are allowed to ripen, one berry of *R*, as shown in 3, contains

more flesh than four fruits of *Q*, for they swell very little in the ripening stages through the greater number of seeds that need support on the branch; indeed, the ripe fruit (4) of *Q* is practically unsaleable as dessert fruit. In *S* is seen wood manufacture at the expense of size in the fruits. The shoot *h*, in *B*, is pinched, growth sturdy, leaves thick, and well exposed to light and air; whilst the shoot in *S* had other shoots to contend with, and equally making for light, hence the long, thin-leaved growth, and, though shortened in summer to *n*, the fruits do not attain to the size and perfection of those on branches which from first to last have been nourished by foliage fully exposed to the light. The bush *T* conveys definite ideas on summer and winter pruning, so that no one ought to fail in producing this national fruit in the greatest abundance and most perfect manner.

Summer pruning should be performed about midsummer, never later than early July; the leaders, in bushes extending, should be allowed to grow, but the side shoots ought to be cut back to about five leaves, as too close pinching may cause the base buds to push.

Winter pruning is best done in November, or it may be conducted any time from the fall of the leaves until the buds start in spring. (When the pruning is confined to thinning the branches and shortening those which are too long, or cutting out worn-out, it may be effected in summer after the bushes are cleared of fruit, this assisting the wood to ripen and store more food.) Where bud-eating birds abound the pruning may be deferred until spring, merely cutting out the branches or spurs denuded of buds. This plan is apt to result in overcrowding and small fruit; and leaving the whole of the young wood to bear often results in a full crop one year and none the next. Bushes that produce fruit mainly on young wood only need judicious thinning so as to keep the trees moderately open, and the leaders require little shortening. This is as it should be—wood produced to bear fruit instead of making work for the knife.

Protecting the Buds.—Bullfinches and house sparrows often denude the bushes of the best buds; this may be prevented by having recourse to the means advised in Vol. I., page 191. Fruit cages—sometimes called gooseberry-houses (Vol. I., page 192)—are very efficient for preventing birds taking the buds in winter and the fruit in summer. Another good plan is to run lines of black thread lengthwise and crosswise of the bushes, forming large irregular meshes by winding the thread round the tips of the branches, this so annoying the birds as to ward off their attacks. This can be done

with great celerity by the "Garden Webber" ("Stott" Company, Manchester), Fig. 66. The cotton unwinds as fast as the stick can be passed over the bushes—ten or twenty times as quickly as by passing the cotton through the fingers.

Protecting the Blossom.—Though the gooseberry is perfectly hardy and passes the severest winter unscathed, the flowers, also the young fruits, are very sensitive to frost. The best-spurred branches, as a rule, suffer the least damage from sudden changes, and the pendulous-growing varieties often escape when the erect-growing kinds suffer severely. A single thickness of tiffany stretched along the top of cordon trees usually saves the crop, and similar means may be employed over bushes, or old newspapers placed on

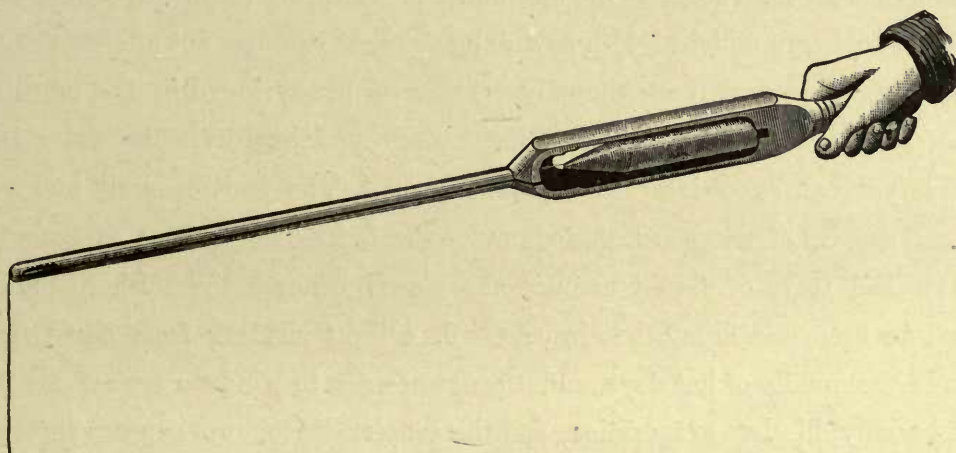


Fig. 66. ROYLE'S GARDEN WEBBER.

them at night, and not removed until the frost has gone, afford effectual shelter, and are kept in place with string attached to the corners.

Thinning the Fruit.—Young green gooseberries are appreciated in every household for pies and puddings, and thinning them persistently for use relieves the trees. In some cases the latter are allowed to carry all the fruit to maturity for preserving or dessert purposes. This in a heavy crop so exhausts the bushes that the produce is scanty in the succeeding year. The spurs cleared of berries have the assimilated matter centred on the buds instead of the seeds in the fruit forming embryonic berries for development in the succeeding year. It is best to gather the whole of the fruit in a green state from the lowest branches, as it may be covered with soil particles splashed up by the rain.

Protecting the Fruit.—Nets are absolutely essential to preserve ripe fruit from birds, and that for hanging must be enwrapped in wasp and bluebottle fly-proof material. Hexagon netting answers perfectly for bushes and wall trees, whilst muslin bags answer for the finest specimens. Fruit for keeping ought to be thin, for decay

occasioned by damp soon spreads from one berry to a whole cluster, and it is a notable fact that gooseberries hang much better on cordon or espalier trees and escape birds better than on bushes. The great difficulty in keeping gooseberries is damp, and this can only be warded off by employing a waterproof covering in wet weather, whilst according a free circulation of air, mats as used for currants not suiting the gooseberry.

Culture.—Gooseberry plantations require identical treatment in respect of manuring, feeding, watering, and keeping the ground free from weeds as currants, which see, but special varieties for particular purposes are given special cultural attention. 1. The soil is removed from over the roots and a dressing of decayed manure applied, and lightly covered with fresh loam in the autumn. 2. In spring (after the fruit commences swelling) the roots are mulched with cow-dung or other manure, not allowing it to dry, but sprinkling water over it occasionally. The trees are syringed in the morning and evening of hot days for keeping the foliage clean and healthy. 3. Water is given abundantly, yet not excessively, in dry weather. 4. The fruit is early and severely thinned, and saucers of water are affixed under the individual berries, as before stated (page 211), and trays of liquid manure are placed beneath the bushes, the vapour being good for them and inimical to insects. 5. A light shading from fierce sun for a few hours in the middle of hot days, and a canvas screen to windward when the weather is dry and windy, hinders evaporation, and the conserved moisture benefits the trees and fruits. 6. When ripening commences the fruit is protected from rain, a reversed saucer answering over "weight" fruits, while "quality fruit" have panes of glass placed over them to throw off rain. Perfected in this way some gooseberries attain an astonishing size, while others are remarkable for superior quality.

Forcing.—The gooseberry succeeds well grown in pots or tubs, therefore may be cultivated by those who have only a place in yards for growing fruit, where a few pots of gooseberry bushes are interesting and useful. Owing to the "blacks" in towns attempts have been made to grow the gooseberry under glass, but, though it succeeds fairly well in cool houses, attempts to force it in green-houses have not been very successful in consequence of insufficient ventilation in the early stages and often lack of moisture afterwards. Still, the gooseberry may be forced, and the routine is the same as that given for currants (page 164).

DISEASES AND ENEMIES.

Diseases.—Some fungi infest gooseberries, depreciating the crops considerably.

Gooseberry Fungus (*Æcidium* (cluster-cup) *grossulariæ*).—This parasite attacks the

leaves and fruits, and is very plentiful in some seasons. The fungus appears as swollen spots or thickened patches on the leaves and fruits, is orange-red, and about $\frac{1}{4}$ inch across. On the affected parts are numerous cups, having the sides (peridium) formed of a single layer of cells, the hollow containing several erect branches springing from the mycelium, each consisting of chestnut-brown, rounded cells, which separate, liberating the spores by the mouth of the cup, each spore pushing out a germinal tube or mycelial thread, which enters a leaf through a stomata. The fungus renders the fruit unfit for use—positively injurious, if not poisonous.

This internal parasite may be prevented spreading by the removal and prompt burning of the attacked leaves and berries. Preventive measures, however, must be taken against its recurrence. Dusting quicklime over the bushes in autumn while damp with mist, dressing the ground amongst them with hot lime at the same time, and spraying the trees in spring with bi-sulphide of calcium or sulphide of potassium, as advised for "Gooseberry Mildew," has proved efficacious. Mr. Graham, in the *Journal of Horticulture*, Vol. IX., third series, page 40, describes his method of prevention as follows:—"In 1868 and 1869 about one-third of the fruit became blotched very much by this fungus. I gave the ground amongst the bushes a liberal dressing with lime in the autumn, and syringed them over with a compound of alum, 1 drachm; tobacco essence, 2 drachms; flowers of sulphur, $\frac{1}{2}$ ounce; common salt, $\frac{3}{4}$ ounce—all mixed in 3 gallons of rain-water; this was done twice before the expanding of the leaf, and again as soon as the fruit appeared fairly set. The first destroyed the germs in the soil [and fallen leaves], and the syringing cleared the bark of its sporules; and my gooseberry bushes are now free from all traces of fungus." The compound used in this case possesses considerable value as an insecticide, and is efficacious against most parasites.

Gooseberry Mildew (*Microsphaera grossularia*).—The thin white coating appearing on gooseberry leaves in spring consists of the mycelium and conidia of this fungus, and

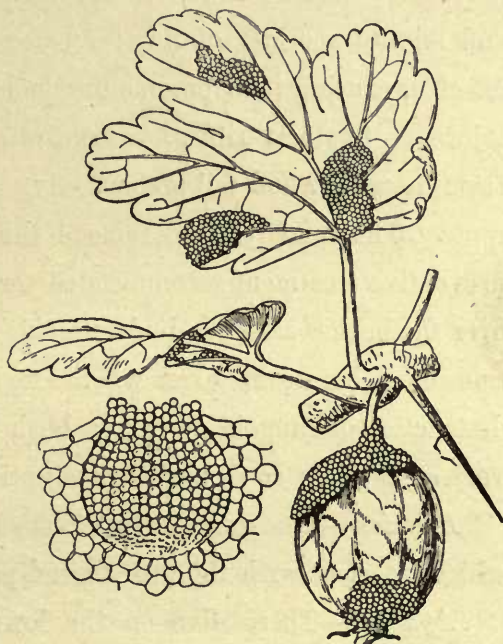


Fig. 67. GOOSEBERRY FUNGUS ON LEAVES AND BERRY, WITH CLUSTER-CUP ON SIDE, OPEN AND DISCHARGING SPORES, GREATLY MAGNIFIED.

the black specks with which it becomes studded after a time, resembling grains of gunpowder, are the "fruits" (perithecia). The mildew clogs the pores of the leaves and extracts its support from them, severely impeding their functions, and the growths and fruit suffer in consequence. The following preparations prevent and destroy the fungus. 1. Bisulphide of calcium (formula, Vol. I., page 248), 1 pint to 12 gallons of water. 2. Potassium sulphide (liver of sulphur), $\frac{1}{2}$ ounce to a gallon of water. Application: spray on the bushes as soon as the leaves unfold, and repeat at intervals of twenty-one days, or oftener if necessary, about twice proving effectual.

Rust (*Septoria grossulariæ*).—Discoloured spots frequently occur on the leaves of gooseberry bushes, and in these are found minute black spots, consisting of the pycnidia and minute sporidia of the fungus. The parasite destroys the substance of the part affected, causing it to become dry and withered, but the gooseberry is seldom seriously injured. *Septoria ribis*, however, often does much damage to currant leaves, causing them to wither and fall prematurely. *Glæosporium ribis* also attacks the leaves of currants. The remedy is to remove the infested leaves and burn them, and follow the preventive treatment recommended for *Æcidium*. Copper solutions are not safe to use over the bushes after the buds unfold, nor until the fruit is gathered, and then the solution must be weak, even when employed on mature foliage and ripe wood for the destruction of fungoid germs, as bush fruits, including blackberries and raspberries, are very susceptible to injury from styptics.

Enemies.—The gooseberry often suffers severely from the attacks of various insects, which interfere with the growth and prejudice the crops.

Aphides.—These live on the lower side of the leaves, causing them to become swollen at the tips of the branches, retarding their growth, and coating the fruit with a sticky excretion, which gathers dust and soot, and becomes suitable fruit for fungi. The most injurious species (several infesting gooseberries and currants) are *Aphis* (*Myzus*) *ribis*, with cylindrical honey-tubes, and *A. (Rhopalosiphum) ribis*, with the honey-tubes widened in the middle; both species are green, with dark markings. The remedies for these pests are the same as described under "Aphides," Vol. I., page 258. Cutting off the tips of the infested shoots and destroying them by fire is a good prelude to applying an insecticide, afterwards syringing the bushes thoroughly with clear water to cleanse the leaves and fruits of the excretions.

Caterpillars.—The larvæ of the gooseberry or magpie moth (Fig. 68), and of the

V-moth in less degree, cause such serious damage to the foliage as to render prompt action imperative.

Magpie Moth (*Abraxas grossulariata*).—This pretty and common moth appears in the evenings of July and August, and is about $1\frac{1}{2}$ inch in expanse of forewings; yellowish-white, variously spotted with black, with a band of pale orange across the spots, and a yellow patch at the base; the hind wings have a yellowish-white ground, without any orange, but black spotted; the black patches and colouring vary much both in size and tint. The body is orange, spotted with black; in the male the antennæ



FIG. 68. MAGPIE MOTH, LARVA, CATERPILLAR-INFESTED AND CLEAN GROWTH.

References:—1, Moth, seated on the under side of a leaf; 2, moth on the wing; 3, larva; 4, infested growth; 5, clean growth.

are slightly feathered, those in the female are thread-like. The female deposits her eggs singly on the leaves of gooseberry and currant bushes (thus securing a wide distribution of the progeny), and from these small looper caterpillars are hatched in a few days, usually in September, feed two or three weeks, and then secure themselves in gooseberry and currant leaves, passing the winter in a torpid state. When the foliage unfolds in spring the caterpillars emerge from their winter quarters, and commence feeding. The caterpillar is yellowish-white, with an orange stripe on each side, and with numerous black spots, the largest on the back, and has conspicuous black bands at the joints. They are full-fed towards the end of May or early in June, and enter the chrysalis

state before the end of the month. In this state they remain about three weeks, and then the moth comes forth. The chrysalis is black, with orange circles round the pointed end, and is enclosed in a cocoon attached to branches, twigs, palings and walls.

V-Moth (*Halia* (*Phalæna*) *Wavaria*).—This moth has the form of the magpie moth; $1\frac{1}{4}$ inch in expanse of wings, grey, with a purplish gloss, and brownish hind margins, the front margin having numerous short streaks and four spots of dark brown, and the second spot joins with a dark spot in the centre of the wing, forming a V, with the tip pointing from the body. It appears in July or August, the female depositing her eggs, one or more, on the leaves of gooseberry and currant bushes, and the caterpillars, passing the winter similarly to those of the magpie moth, are most conspicuous in May. They are loopers, cylindrical, dull green or lead colour, head lead-coloured, with dark markings, body wavy (slightly dilated), lined lengthwise with smoke-colour, and with yellow spots along each side, with three black warts in each spot, and a black bristle issuing from each wart. When full-grown the larva becomes pupa suspended in a slight web among the leaves on the twigs.

The very best preventive of magpie and V-moth caterpillar attacks is thorough cultivation, not pruning the bushes until the leaves are all down, then collecting and burning, leaving not one behind. To facilitate clearing away the leaves in autumn the ground beneath the bushes should be made firm, smooth, and even early in September, and the remedies advised against the gooseberry and currant saw-fly caterpillar may be practised in spring.

Gooseberry and Currant Saw-fly (*Nematus ribesi*).—This insect appears in spring. Its body is yellowish brown; antennæ also brown and nine-jointed; the crown of the head, eyes, three large spots divided by a line on the back, and a large spot on the breast are all black; belly orange; wings transparent and reflect the colours of the rainbow, with the spots on the fore-wings brown; legs yellow, with brown tips. The female deposits her eggs on the under side of the leaves of gooseberries and currants, on or near the midribs, and the caterpillars hatch out in a week to ten days, and at once commence feeding, piercing the leaves through into numerous small holes. The caterpillars are bluish-green; the head, tail, feet, and spots on the segments are black, with one yellow ring by the head and tail, and have twenty legs. The caterpillars feed in companies with tails raised in the air, as shown in Fig. 69, which also portrays the insect.

The caterpillars are most abundant and destructive during May and June, but successional broods are hatched from the beginning of May until October. When

full-fed they become pale green, yet retain the yellow rings and two black spots on the head, and soon afterwards enter the soil, forming yellowish-brown cocoons, in which they change to chrysalids, from which the saw-flies emerge in about three weeks. The later broods of caterpillars, however, pass the winter unchanged in the cocoons, yet turn to chrysalids in time to appear as saw-flies with the unfolding of the gooseberry leaves.

The following practice is very old, and effective in preventing attacks of gooseberry and currant saw-fly caterpillars:—Remove the soil under the bushes to a depth of 2 inches or a little more, in loose soil as far as the branches extend, and bury it in a trench,

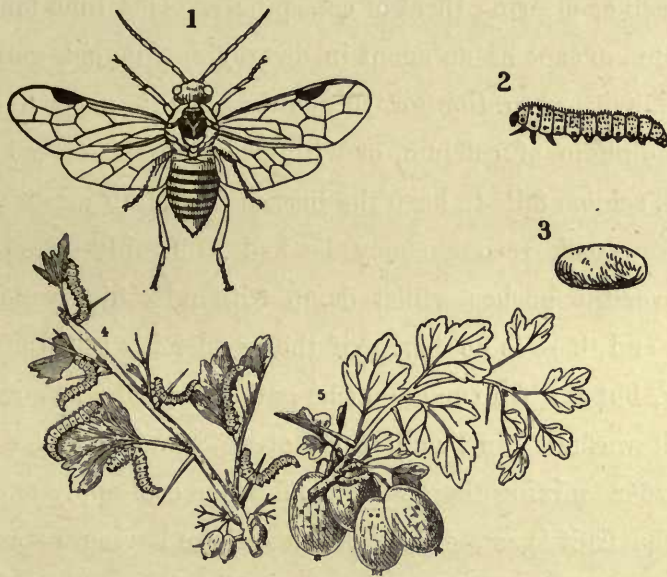


Fig. 69. GOOSEBERRY AND CURRANT SAW-FLY; CATERPILLAR-INFESTED AND CLEAN BRANCH.

References:—1, Male saw-fly, enlarged; 2, larva; 3, cocoon; 4, infested branch; 5, clean growth.

taken out in the open space between the rows of trees, not less than 1 foot deep, treading it well down, placing the worst soil taken out of the trench on the top. This converts the cocoons and their contents into manure, and fresh soil is brought up for amelioration. Then sprinkle quicklime over the bushes, supply an inch thickness of manure or rich compost in place of the surface soil removed, and cover it with an inch of the best soil taken out of the trench. Thus the bushes receive an annual nourishing dressing, and flourish.

Where the soil is loose it should be firmed in September, as advised for the magpie and V-moth, and where the bushes cover the whole of the ground, a pit may be prepared

elsewhere, removing the soil under the bushes and burying it deeply in the trench, the best soil taken out of the pit, along with an addition of rich compost or manure, taking the place of the removed surface soil.

Another very simple and excellent plan is to firm the soil beneath the bushes in summer, which causes the caterpillars to form cocoons on or barely within the soil, and when the leaves fall they are drawn off along with the loose surface soil and deeply buried, or preferably burned; the ash may then be returned. A dressing of quicklime and soot is then applied to the ground and pointed in lightly. After the leaves unfold in spring, the bushes are dusted with equal parts of dry soot and air-slaked lime, and this, if repeated whilst the foliage is damp, greatly assists the trees and renders them obnoxious to the saw-flies as well as clearing them of caterpillars. Gas lime must not be used on or near the stems, and, except as an agent in destroying fungoid germs and cleansing foul land of insect pests in preparation for fruit culture, should never be used. Syringing the bushes with bisulphide of calcium, or with clear lime-water, as advised for early attacks of red spider, seldom fails to keep the bushes free of all insect pests.

In case of severe attack recourse may be had to freshly-ground white hellebore powder, dusting it over the bushes whilst damp with an ordinary flour-dredger. This extirpates the pests, and there is no danger if the powder is washed off with clear water at the end of a week, but the fruit must not be gathered in the meanwhile. Or dissolve 1 ounce of size (whitewashers') in 1 gallon of hot water, add 1 ounce of freshly-ground white hellebore powder, mixing thoroughly, and when cool apply on a dry day to the bushes, as soon as the fruit is set, either with a syringe having a spraying nozzle, or a fine rose watering-can. The mixture adheres to the leaves, one application in most cases sufficing for the season, and must be washed off before the fruit is gathered. One pound of white hellebore powder is enough for sixty large bushes when syringed on, but if sprayed on, so as to leave a thin film on the foliage, it goes four times farther.

Some growers dust the bushes with fine dry road-dust, shake or strike them sharply, and trample the dislodged caterpillars on the ground. Others use narcotics to bring off the caterpillars, such as tobacco powder dusted on the bushes whilst damp, or syringe with quassia-water. Pepper also brings the caterpillars down, and they should be trampled under foot. We prefer destroying the cocoons, giving the trees manure and fresh soil annually, thus securing clean growths and bountiful crops. Cuckoos are the great natural foes of gooseberry and currant caterpillars.

Other saw-fly caterpillars feed on the leaves of gooseberries, and, though widely

diffused, are not very common. *Nematus appendiculatus* and *N. consobrinus* larvæ are troublesome in some years on gooseberry and currant bushes, and both are green in colour. The former species has a black abdomen in the saw-fly, and is the smallest. The latter is also smaller and duller in colour than *N. ribesi*, and there is only one brood of caterpillars in a season, these passing into the ground to pupate: they are easily cleared away in winter as advised for *N. ribesi*.

Red Spider.—This pest (*Bryobia* (*Acarus*) *speciosa*) sometimes appears on gooseberry leaves in dry weather during April, and loses no opportunity of preying on the trees during the season. Syringing thoroughly with bisulphide of calcium (Vol. I., page 248) or lime-water (Vol. I., page 260), and repeating a few times, is a simple, safe, and efficient remedy, but feeding the roots with water or liquid manure and mulchings is also necessary in dry seasons and in hot soils.

GRANADILLAS.

GRANADILLA is the term applied to the edible fruit of different species of Passion Flower, but one only is the true Granadilla, *Passiflora quadrangularis*, yet other species are largely cultivated for their fruits in tropical countries, and are deserving of greater attention than has hitherto been bestowed upon them in this country. Some of the most desirable species are the following :—

PASSIFLORA EDULIS.—Edible-fruited ; flowers white, tinged with purple, fragrant ; fruit purple, about 2 inches long and $1\frac{1}{2}$ inch in diameter ; pulp bright yellow or orange, mildly acid, agreeable, resembling an orange ; native of Brazil. Very productive ; succeeds in a warm greenhouse. See fig. 70, next page.

P. INCARNA A.—May apple ; flowers white petaled, corona double-rayed and purple ; fruit orange-coloured, about the size of an apple ; pulp yellow, with a sweetish taste ; Southern States of North America ; herbaceous, shoots springing up annually. Succeeds in a light greenhouse.

P. LAURIFOLIA.—Jamaica honeysuckle ; water lemon ; flowers red and violet, fragrant ; fruit yellow, dotted over with white spots ; size about that of a hen's egg, ends pointed ; pulp whitish, watery, usually sucked through a small hole in the rind, delicately acid, aromatic flavour and "quenches thirst, allays heat, induces an appetite, and elevates

the spirits" ; West Indies and South America, where it is much cultivated. Requires a stove temperature.

P. MALIFORMIS.—Apple-fruited granadilla ; sweet calabash ; flowers large, beautiful, petals white, rays blue, outer divisions red ; sweet-scented ; fruit ovate, pointed at the apex, 2 or 3 inches in its longer diameter, and when ripe is of a dull dark yellow colour ; pulp pale yellow, gelatinous, with an agreeable flavour, particularly when eaten with wine and sugar ; tropical America. Needs a stove temperature.

P. QUADRANGULARIS.—Granadilla ; flowers large, fragrant, petals red within, and white outside, corona white, with violet rays ; fruit greenish-yellow, oblong, about 15 inches in circumference ; pulp purple, succulent, sweet and slightly acid, pleasant, especially with wine and sugar ; Nicaragua ; largely grown in tropical countries.

Propagation.—Seedling plants grow quickly and fruit indifferently ; therefore the plants should be raised from cuttings. Short-jointed young shoots, about 6 inches long, taken in spring with a heel, inserted singly in small pots, in sandy soil, placed in a close propagating frame, or under a bell-glass, root freely with the requisite amount of heat, shade, and moisture. When rooted, gradually inure the plants to the air, shifting them into larger pots as the growth progresses.

The plants may be fruited in large pots or tubs, but to have abundant crops they require planting in beds, but unless the roots are restricted the plants do not fruit freely. A border 2 feet wide along the front of a house will support a plant on a trellis ten times wider. This is a good way of apportioning the rooting area to the trellis space, namely, 1 foot square of the border to every 10 feet superficial of trellis. Corners of

pits in plant houses, or pine stoves walled off from the bottom, form fitting receptacles in which to plant, training the growths near the glass over the pathways.

Drainage.—The drainage must be very complete, for though the plants require an abundant supply of water during the summer season, any approach to stagnancy is

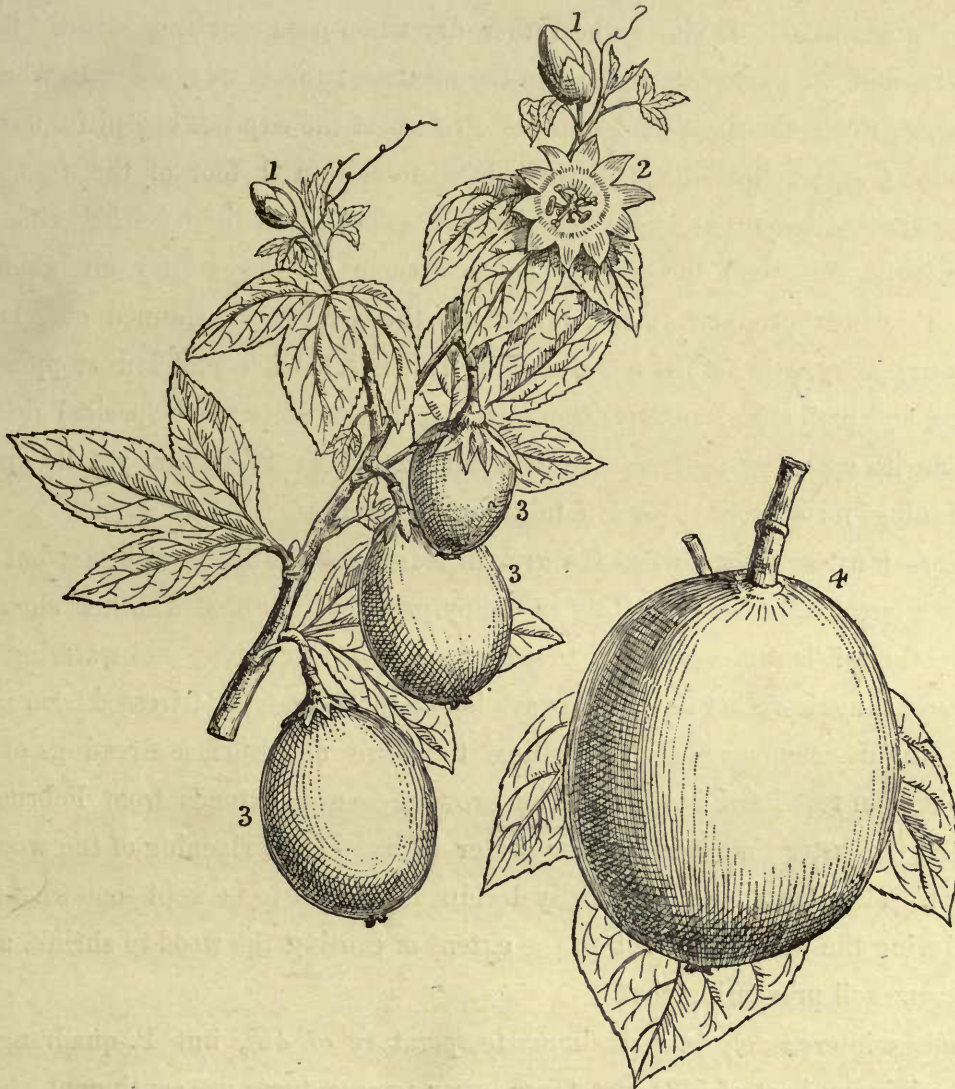


Fig. 70. FRUITING SPRAY OF PASSIFLORA EDULIS.

References :—1, Flower buds ; 2, flower ; 3, fruits in various stages of swelling ; 4, medium-sized ripe fruit.

pernicious. A foot in depth of clean rough rubble, with 3 inches of finer on the top, is not too much for borders, but remember that a drain, with outlet, is necessary to carry off the superfluous water. Pots and tubs must be efficiently drained, about a fourth of their depth sufficing. Avoid deep borders ; 1 foot of compost is ample ; if the border

space is deep, place in rubble to bring it up to the right height, leaving only sufficient depth for soil.

Soil.—Turfy, yellow friable loam, torn or chopped up roughly, three parts; leaf mould or old decayed cow manure, one part; crystal or drift sand, half a part; charcoal in pieces from the size of a pea to a hazel-nut, half a part, well mixed, form a suitable compost for granadillas. It should be rather dry when used, and pressed down firmly. Some growers add one part of sandy peat to the mixture; this is advantageous when the loam is rich, as rich soils cause exuberance of growth at the expense of fruitfulness.

Management.—The shoots must be carried up to within 1 foot of the roof, then trained over the trellis so that every leaf has full exposure to light. This is a vital point in training, for when the young shoots become interlaced they are weak and fruitless. *P. edulis* produces many branches; these must be thinned out, but no stopping is necessary, at least till a full crop of fruit is set, when judicious stopping aids the swelling and perfecting. *P. quadrangularis* (and the other stove species) does not crowd itself with spray to anything like the same extent as *P. edulis*, yet its growths require thinning, for overcrowding is fatal to productiveness.

Watering—must be liberal when the growth is free and the fruit swelling; but over-watering is a great mistake, resulting in sappy growths. Sufficient water should be given when the soil is somewhat dry, to pass down to the drainage, not watering again before the soil is again rather dry, yet always before the foliage is distressed from lack of moisture. Liquid manure assists in swelling the fruit, and surface dressings of turfy loam aid plants in restricted borders. The growing season extends from February to October. At the latter time withholding water facilitates the ripening of the wood and induces rest. The plants becoming partly deciduous, require to be kept somewhat dry at the roots during the winter, yet not to the extent of causing the wood to shrink, a little moisture in the soil preventing that.

P. edulis winters safely in a minimum temperature of 45°, but *P. quadrangularis* requires a minimum heat of 55°; yet these lower temperatures are contingent on a dry condition of the atmosphere and soil, with thoroughly ripened wood. *P. edulis* succeeds admirably in the temperature of a vinery; *P. quadrangularis* requires stove heat. Pruning is best performed just when the plants are commencing growth. The shoots can then be thinned out and shortened, spurs cut-in to one or two buds, old wood removed and young laid in, always pruning to firm, thoroughly-ripened wood, for none other is healthy and fruitful.

A free use of the syringe is sometimes necessary in summer to prevent or dislodge red spider and thrips, but during the flowering and the setting of the fruits syringing must be discontinued, for it is then important to have the flowers dry. Ventilate the house rather freely, especially in the early part of the day, and look over the plants about noon for fertilising the blossoms by plucking one of the anthers with ripe pollen and applying it to the face of the stigmas. This answers for *P. edulis* and *P. incarnata*. *P. quadrangularis*, however, has succulent floral appendages, and it is advisable to cut off the whole of the calyx, corolla, and corona with sharp-pointed scissors, leaving only the five stamens and the three stigmas, taking care not to injure the flower-stem. Then cut a stamen bearing an anther with ripe pollen, without shaking the pollen out, and touch each stigma with the anther, covering all the stigmas with the fertilising dust.

Avoid over-cropping; one fruit of *P. quadrangularis* to 18 inches square of trellis is ample. Other kinds may be cropped more freely, remembering, however, that fruits are small and insipid through overcropping, also crowding the foliage, combined with improper nourishment.

The fruit ripens about August—sooner if growth is started early—and successionally until October. It imparts a pleasing variety to desserts, and to some palates the flavour is agreeable and the juice refreshing. Ripe fruits keep a fortnight in a dry room. Fruits of *P. edulis* are sometimes made into conserves, and excellent jelly has been made from them.

GRAPE VINES.

THE Grape Vine (*Vitis vinifera*) is found growing wild in Southern Europe, Northern Africa, and Western Asia. Its native country cannot be determined satisfactorily, yet it appears indigenous to that part of Asia Minor south of the Caucasus Mountains and the Caspian Sea, and includes Armenia, Palestine, Syria, and Persia. De Candolle, in *L'Origine des Plantes Cultivées*, states:—"Seeds of the grape vine have been found in the lake dwellings of Castone, near Parma, which date from the age of bronze. Vine leaves have been found in the tufa round Montpellier—probably deposited before the historical epoch. Its dissemination by birds and other agencies must have begun very early—perhaps before the existence of man in Europe, or even in Asia." The cultivated grape vine, however, appears to have followed the footsteps of man. Grapes were grown and wine made in Egypt 4000 B.C. Noah, 2348 B.C., "planted a vineyard." The men sent by Moses in 1490 B.C. to search the land of Canaan "came unto the brook (or valley) of Eshcol, and cut down from thence a branch with one cluster of grapes, and they bore it between two upon a staff." The soil and climate of Judea were so well suited to the growth of the vine that grapes were among its principal productions, and particular districts, as Engedi, and the vales of Eshcol and Sorek, were famed for the excellence of their grapes. Sorek signifies the noblest variety of the vine—a white grape (with delicious juice, small and soft seeds), from which the best raisins are made in Persia, and the celebrated Kishmish wine of Schiraz.

The Phoenicians first introduced the vine into Europe—Greece and Italy, whence it spread into France and other parts of the Continent. It is supposed that the Romans introduced the vine into Britain A.D. 10. Tacitus, son-in-law of Agricola, governor of Britain and teacher of its inhabitants in the "arts and luxuries of civilization," declared, about A.D. 97, that "the moist climate (of Britain) was unfavourable to the vine maturing its fruit." Domitian issued an edict in 85 prohibiting the planting of new vineyards in Italy, and directed those in the provinces to be destroyed. Probus rescinded that edict in 280, and Britain is mentioned as a province allowed to cultivate the vine.

The battle of Hastings was fought near a great plantation of vines. Domesday Book, a record of a statistical survey of England made by command of William the Conqueror, towards the latter part of his reign (1066-1087), contained thirty-eight entries of valuable vineyards, two of six acres each, one at Ware, and one in Essex, the latter yielding 20 hogsheads of wine in a good year. The Isle of Ely was called by the Normans "L'Isle de Vignes" (Isle of Vines), and the Bishop of Ely's yearly tithe of wine was three or four tuns. The vineyard of Peterborough was planted by the abbot in the time of Stephen (1135-1154). Prior John, of Spalding, planted both vineyards and orchards, and others were planted by the Abbots of Denny Abbey, in Cambridgeshire, of Dunstable, Bury St. Edmund's (remains of which still exist), and other abbeys. In 1140 the barons as well as the monks possessed vineyards. "Vineyard Holm," a sheltered, sunny hollow of the Hampshire Downs, tells its own history; and the warm slopes of the "vineyard hills" at Godalming, in Surrey, were once hung with vines. Canterbury had its vineyards, at the Abbey of St. Augustine and the Priory, and several places derive their names from their having been the site of vineyards, though none appear to have existed farther north than Derbyshire. Gloucestershire was the chief wine district in England. William of Malmesbury states "there were more vineyards and better grapes grown in that county than in any other part of England." That was about 1148, and traces of a vineyard still exist at Tortworth.

Vineyards were successful as long as they were connected with the abbeys and priories, because many of their inmates were foreigners understanding vine culture. But in the reign of Henry II. (1154-1183) vineyards began to be neglected, partly on account of disputes with the ecclesiastics, but mainly through our actual possession of a portion of the vine-producing districts of France. Yet vineyards are mentioned in the reign of Henry III. (1216-1272) that produced grapes making excellent "native wine." In Edward II.'s reign (1307-1327) the Bishop of Rochester sent theking "a present of his drinks, and withal both wine and grapes of his own growth at his vineyard at Halling." The battle of Poitiers was fought (1356) in a French vineyard, and French wine became the fashion—relished as the produce of English provinces in France; but "native wine" was made in considerable quantities from the produce of the grape vine during the sixteenth and seventeenth centuries, as attested by Dr. Plot, Barnaby Googe, Samuel Hartlib and others.

The first Earl of Salisbury planted a vineyard at Hatfield about 1605. Dr. Ralf Bathurst made claret at Oxford in 1685, "as good as one could wish to drink." Vines were grown

on the steep southern slope of a hill at Deepdene, Dorking; Defoe found "the vineyards at Deepdene neglected" in 1726. Sir Henry Lyttleton made wine from grapes at Over-Ashby, a warm nook in Staffordshire. Dr. Shaw's vintage at Kensington "equalled the lighter wines of France," and the Hon. Charles Hamilton made "excellent champagne" from grapes produced at Pain's Hill, near Cobham, on the south side of a gentle hill, where the soil was warm, gravelly, and dry. Collinson, writing to Linnæus under date of October 3rd, 1748, says: "We have had a fine summer. . . . My vineyard grapes are very ripe. . . . A considerable quantity of wine will be made this year in England." There was a noble vineyard at Arundel Castle, Sussex, and in 1763 there were sixty pipes of English Burgundy in the Duke of Norfolk's cellars there, "better than imported and very superior to what is generally drunk in France." A cycle of wet cold summers commenced in 1790, and "vineyard grapes ceased to yield good vinous juice for a period of twenty-five years." The art of wine-making then appears to have been lost, and prejudice completed the ruin of vineyards in England; yet we have shown that for many centuries this country was satisfied with the wine of its own growth, and there are many dry sunny slopes in the warmest parts of England which might be profitably covered with vines, while it is well known that vines flourish and produce grapes against the south walls of buildings in various parts of this country, as far north as York, the wine made from them excelling the trashy mixtures sold from the Continent. This is a branch of vine cultivation deserving of more attention.

Artificial heat was first employed for the production of grapes in England in 1718. Lawrence's *Fruit Calendar* says: "Fires were constantly kept up from Lady Day to Michaelmas behind the slope-walks on which the vines were trained," at the Duke of Rutland's, at Belvoir Castle. Gilpin states that the Black Hamburg vine at Valentines, Ilford, Essex, was planted in 1758. This vine still exists in suckers from the parent stem, which is dead. The Hampton Court vine is said to have been a cutting from the vine at Valentines, and was planted in 1769. It has a stem $3\frac{1}{2}$ feet in circumference, occupies a house 66 feet long by 30 feet wide, and produces 1,700 bunches of useful grapes yearly. The old vine at Cumberland Lodge, Windsor Park, ripens 2,000 bunches of grapes. It was found in a cucumber pit about 1800, and now occupies a house 138 feet long and 20 feet wide; its stem is nearly 4 feet in circumference. The fruit produced by these two vines is small but of excellent quality, and is reserved for Her Majesty's table. A great vine exists at Sillwood, Sunninghill, and is said to be a descendant of the Black Hamburg vine at Cumberland Lodge. It occupies a house

129 feet long by 12 feet wide, has a stem 3 feet in circumference, and produces 1,800 bunches of acceptable grapes a year. Another great Black Hamburgh vine is found at Kinnel House, Breadalbane, Scotland, filling a house 172 feet long by 25 feet wide; it was planted in 1832. The Speddoch vine, also in Scotland, is famed for its splendid fruit.

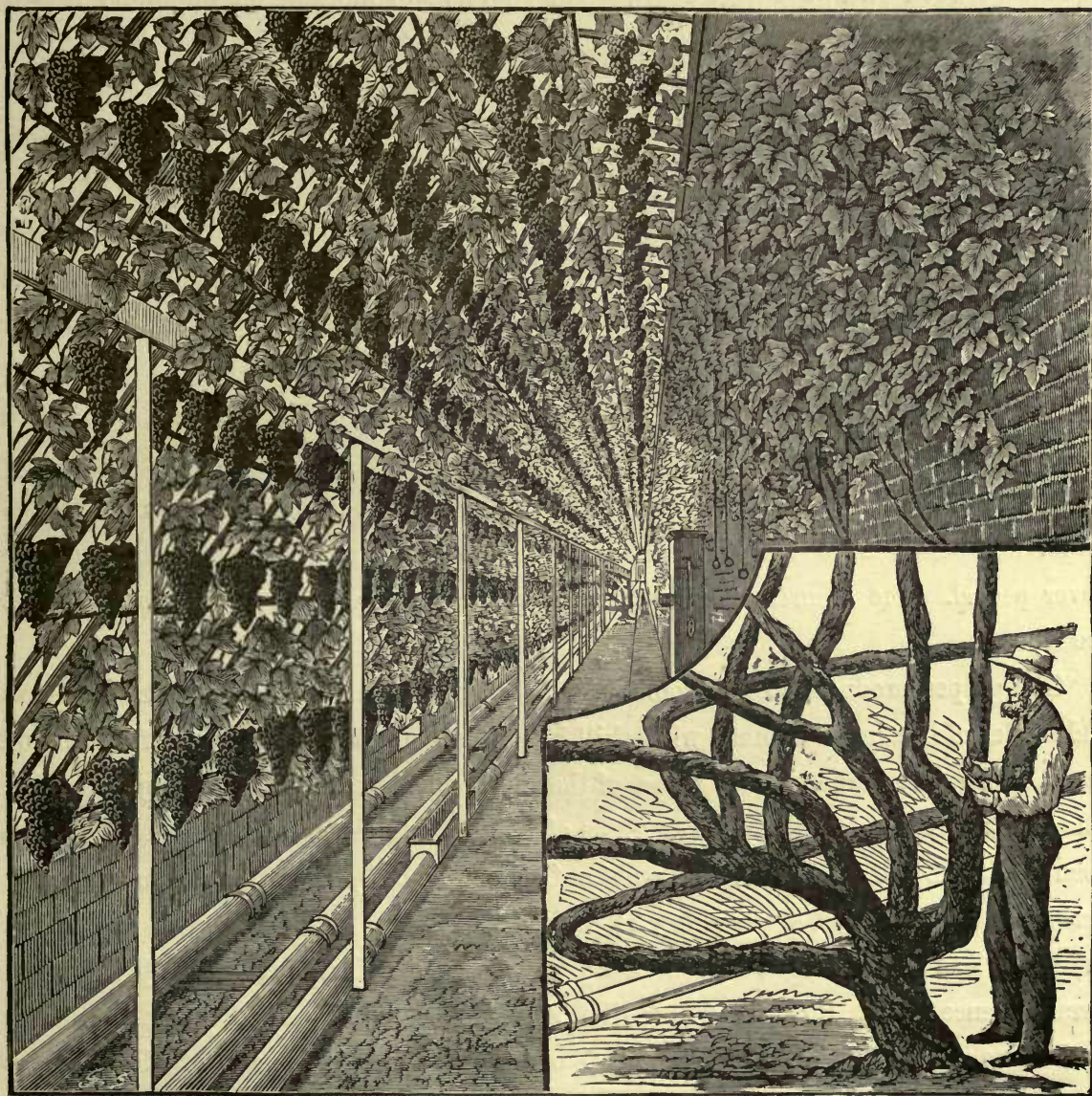


Fig. 71. THE MANRESA VINE. (From the *Journal of Horticulture*, vol. xv., third series, page 140.)

The "leviathan of vines in England" is the Black Hamburgh vine at Manresa House, Roehampton (Fig. 71), raised from a cutting by the present gardener, Mr. M. Davis, in 1862. After filling a house 70 feet long the present structure was erected. It is a

sharply-pitched lean-to, facing south-east, with a short hip of about 18 inches from the top of the wall. The height of the back wall is 12 feet, the front wall 1 foot, and the length of the house 224 feet. The vine has seven rods trained horizontally under the roof, the lower one just so that the bunches of fruit hang clear of the hot-water pipes, which are close to the ground, the upper rod under the apex, the other five rods equidistant between—about 2 feet apart. No laterals are allowed on the under side of the rods. The laterals are 1 foot apart, trained upright, and stopped at the rod next above them. Every alternate lateral is allowed to carry a bunch; they, therefore, carry fruit in alternate years. The seven rods have an aggregate length of 1,400 feet, or more than a quarter of a mile. About 1,800 bunches are usually removed from this vine when small, and from 600 to 800 retained, some of which have weighed between 3 and 4 pounds, while many berries have exceeded 3 inches in circumference, and in colour and finish were all that could be desired. The crop is usually sold for about £100.

The Manresa vine is growing in the natural soil—a free clayey loam, and is fed inside the house with nearly fresh horse-droppings placed on the soil and frequently sprinkled with water, the ammonia-charged vapour given out proving inimical to red spider and beneficial to the vine. It is pruned on the spur system, and the rods are never peeled. The Manresa vine is a remarkable sight when the long lines of grapes are ripe.

The grapes produced in this country, with all the advantages of modern structures and modes of heating, combined with skill in cultivation, surpass, in size of bunch and berry, finish and high quality, those of the most celebrated grape-growing countries. The Black Hamburgh is the popular grape of Britain, and remarkable bunches of it have been produced. Mr. Hunter, of Lambton Castle, Durham, exhibited a bunch of this variety at Belfast in 1874, weighing 21 pounds 12 ounces; and Mr. Davis, at Oakhill, in 1858, had berries in a bunch of $8\frac{1}{2}$ pounds weight that measured $4\frac{1}{2}$ inches in circumference. Mr. Roberts, Charleville Forest, Ireland, exhibited a bunch of Gros Guillaume in 1877 weighing 23 pounds 5 ounces, the heaviest bunch of black grapes on record (see Fig. 72). Gros Colman is the noblest black grape. Mr. Goodacre, of Elvaston Castle, has had fourteen bunches on a vine weighing 40 pounds, with berries individually measuring 5 inches in circumference.

Of white grapes (so called), Muscat of Alexandria is the choicest and most valuable grown in Britain. Though robust in growth, few large vines exist of this

grape. There is one at Harewood House, Leeds, planted by Mr. Chapman in 1783, filling a house 66 feet long by 18 feet wide, and producing 300 bunches annually. Canon Hall Muscat is the handsomest Muscat grape and has the largest berries, sometimes measuring singly 4 inches in circumference. Trebbiano has, however, produced enormous bunches of light-coloured grapes; one was grown by Mr. Currer, of Eskbank, Edinburgh, and exhibited in 1875. It weighed 26 pounds 4 ounces; this is the heaviest



Fig. 72. BUNCH OF GROS GUILLAUME GRAPES. Weight: 23 pounds 5 ounces.
(Reduced from *The Gardeners' Chronicle*.)

bunch of grapes which has been weighed in public. Mr. Dickson, of Arkleton, exhibited a bunch of White Nice grapes at Edinburgh, in 1875, weighing 25 pounds 15 ounces, the produce of a vine which had only been planted four years. This huge bunch measured across its ponderous shoulders 2 feet 3 inches; the length of the bunch was 2 feet 3 inches, and its circumference, following the contour of the shoulders to the body

of the bunch, precisely 8 feet. Its weight when first cut is said to have been 26 pounds 8 ounces. This (Fig. 73) is the largest bunch known, and the berries were



Fig. 73. BUNCH OF WHITE NICE GRAPES. Weight: 26 pounds 8 ounces.
(From *The Journal of Horticulture*.)

of full size through having been thinned. The Eskbank bunch was not thinned to the same extent, if at all, but the berries were crushed together in a dense, compact mass.

VARIETIES.

Though many varieties of grapes have been introduced, and several seedlings raised, comparatively few are generally cultivated in this country, and the tendency of growers points to still greater limitation so as to utilise the means to the best advantage. Grapes,

however, are grown in so many different ways, and the tastes of individuals are so various, that a greater number of varieties are needed than may appear desirable or useful in supplying the household or markets with grapes the year round. Some sorts have little to commend them beyond size of bunch, yet these are much appreciated on special occasions, as at parties and exhibitions; therefore, provision must be made for special as well as general requirements.

I.—CHASSELAS OR MUSCADINE GRAPES.

Varieties with transparent, juicy, sweet flesh, of a peculiar crackling firmness and rich agreeable flavour, with the aroma peculiar to this class, namely, a blending of the Muscat and Frontignan—hence the term Muscadine.

CHASSELAS VIBERT (White).—Bunches cylindrical, 6 to 12 inches long, and well set; berries medium to large, round; skin whitish yellow, becoming golden amber when quite ripe, thin and transparent; flesh firm, juicy, sweet, rich, and pleasant; leaves medium sized, pubescent above and beneath, dying off yellow; vine hardy and prolific; ripens ten days earlier than the Royal Muscadine; the best of all grapes for walls; admirable for an unheated house.

ROYAL MUSCADINE (Chasselas de Fontainebleau; White Chasselas).—Bunches variable: in firm good soil cylindrical, compactly shouldered; in loose soil, long and loose-shouldered; in poor soil small and

blunt; free setting; berries round, in fine samples slightly oval, medium to large when well thinned; skin greenish yellow, pale amber with russet when highly ripened, thin and transparent, covered with a delicate white bloom; flesh rather firm, but tender, juicy, sweet, and richly flavoured, with a pleasing aroma; leaves small, roundish, dying off pale yellow; vine free in growth, excellent in constitution, hardy, and an abundant bearer; the variety commonly grown against walls in this country, where it succeeds splendidly; in a cool house it ripens a fortnight before the Black Hamburg, and hangs until shrivelled, when the flavour is very rich.

II.—FRONTIGNAN GRAPES.

The varieties are characterised by roundness of berry, thin skins, firm, crackling, tender flesh, juiciness, sprightly sweetness, very rich Muscat flavour, and delicious aroma.

JULY FRONTIGNAN (Black).—Bunches small, cylindrical, compact, setting freely; berries medium sized, round; skin deep purplish black, with a dense blue bloom; flesh tender, very juicy, sugary, richly flavoured, with a delicate Muscat aroma; leaves small to medium, not deeply lobed, rounded, serrated, dying off reddish; vine free, but moderately vigorous in growth, hardy, and a prolific bearer; ripens on an open wall with Early Smyrna Frontignan, and succeeds admirably in a cool house.

MEURTHE FRONTIGNAN (Black).—Bunches medium sized, cylindrical, occasionally with a small shoulder, very compact, setting freely; berries medium to large, round; thick, slightly warted; skin deep purplish black, covered with a beautiful blue bloom, thin, with a conspicuous style-point; flesh very firm, crackling, juicy, sugary, and rich, with a brisk, very delicious Muscat flavour; leaves small to medium, rounded, not deeply cut, but rather deeply serrated, dying off purplish; vine moderately vigorous in growth and a free bearer;

the finest black Frontignan, succeeding well in an ordinary mid-season vinery, also fairly in a cool house.

DR. HOGG (White).—Bunches tapering, 12 to 18 inches in length, shouldered, rather loose, but freely set; berries medium sized to large, sometimes 1 inch in diameter, round; skin clear, thin and membranous, yellowish green, becoming a rich amber when highly ripened; flesh firm, sweet, with a sprightly, delicious, high Frontignan flavour; leaves medium sized, rather deeply serrated; growth vigorous, fruiting freely; this is the best of the white Frontignan grapes, equalling Chasselas Musqué in flavour, and never cracking like that variety; succeeds in a mid-season house, but requires more heat than the Black Hamburg to bring out its amber colour and rich flavour.

EARLY SMYRNA FRONTIGNAN (White).—Bunches cylindrical, 6 or 7 inches long, well set; berries medium sized, round; skin bright amber when ripe, dotted over with minute russet dots; flesh

firm, melting, very juicy, rich, and with a brisk, delicious Muscat flavour, having an orange-flower aroma; leaves medium sized, toothed and lobed similar to White Frontignan; vine free and moderately robust in growth, very prolific; ripens well in a cool house, and on the open wall with the Royal Muscadine.

WHITE FRONTIGNAN.—Bunches cylindrical, seldom shouldered, long, medium sized, compact, freely set; berries medium sized, round; skin greenish

yellow, with a grey bloom, becoming russety when highly ripened; flesh firm, very juicy, remarkably sweet, very rich, and with a high Muscat flavour; leaves deeply lobed and serrated, dying off yellow; vine free and moderately vigorous in growth; fruiting abundantly; one of the best grapes for early forcing, whether in pots or in borders; produces richly flavoured fruit in a mid-season house, and ripens in a cool house, but only in fine seasons perfectly.

III.—MUSCAT GRAPES.

Varieties in this class are distinguished from Frontignans in having oval and larger berries, and a vinous juice, combined with a musky flavour. The vines are also more robust in habit, and require more heat with a longer time to ripen the fruit perfectly. Considerable modification has been effected in this class through cross-fertilisation, but no varieties are admitted here that are not decidedly Muscat-flavoured.

BLACK MUSCAT (Muscat Hamburgh; Venn's Black Muscat).—Bunches large, with long and loose shoulders, often badly set; berries medium to large, oval to roundish oval; skin reddish, purple to purplish black, covered with a fine blue bloom, thin, yet tough; flesh rather firm, melting, very juicy, sugary, rich, with a delicate Muscat flavour; leaves large, somewhat flaccid, deeply lobed, and serrated; vine moderately vigorous, and a free bearer, though the grapes are prone to shank, and this, combined with the berries setting indifferently, has led to grafting it on various stocks, especially the Black Hamburgh, on which it succeeds better in a moderate temperature. To have this, "one of the finest of grapes" (Rivers), in perfection, it requires to be grown as a mid-season variety in a warm house.

MADRESFIELD COURT (Black).—Bunches long, tapering, compactly shouldered; stalk stout and short; berries large, oval or oblong, even in size; stalks short, stout and warted, setting freely; skin tough and membranous, purplish black, covered with a dense blue bloom; flesh greenish, tender, juicy, sweet, and rich, having an appreciable Muscat flavour; leaves medium size, wrinkled, deeply lobed, leafstalks rough, dying off dark crimson; vine moderately strong and free in growth; shoots downy, with prominent buds; free bearing. This is a very handsome grape, valuable for early and mid-season use, but does not hang well through its liability to crack and lose colour. Having a good constitution and setting freely, it succeeds in a cool house, but is seen to the best advantage as an early grape, afforded the same temperature as the Black Hamburgh.

MRS. PINCE (Black).—Bunches large, long, tapering, shouldered, close, compact, though often badly set; berries medium-sized, oval or oblong; berry-stalks short, stout, and warted; skin thick, tough and membranous, deep purplish black, with a thick blue bloom; flesh firm, crackling, vinous, rich, with a fine Muscat flavour; leaves strong and leathery, wrinkled and downy; vine very vigorous, long-jointed, fairly fruitful. A high-class late grape, requiring the heat of a Muscat house and to be started in March, as it takes a considerable time to ripen perfectly. It is an excellent keeper, though apt to shrivel and lose colour. It succeeds fairly well in a mid-season house, and is best grown on the long-pruning system.

CANON HALL MUSCAT (White).—Bunches large, broadly shouldered, bluntly tapering, footstalks thick and fleshy; berries very large, bluntly oval, sometimes nearly round, often set badly; skin pale yellow, thin; flesh firm, slightly crackling, very juicy, vinous, rich, with a sprightly and particularly fine Muscat flavour; leaves large, somewhat flaccid, rounder and less deeply lobed than the Muscat of Alexandria, dying off yellow; vine remarkably strong, having thick wood with large buds; moderately fruitful. This is the noblest Muscat grape. The growths must be thinly disposed and not hurried in the early stages, in order to secure a sturdy habit and strong well-developed flowers, affording plenty of heat to perfect the fruit and ripen the wood. When produced in the greatest perfection it brings the highest encomiums at table, and the highest price in the market.

MRS. PEARSON (White).—Bunches large, 9 to 12 inches, long, tapering, boldly shouldered, footstalks thick,

strong, freely set. Berries roundish oval, with short, stout, warted footstalks; skin amber coloured, thick, membranous, tough; flesh firm, very juicy, vinous, sugary, rich, with a sprightly Muscat flavour; leaves medium sized, stout, deeply serrated and lobed; vine very robust and fruitful. A late grape of high quality, requiring a long time and strong heat to ripen perfectly.

MUSCAT OF ALEXANDRIA (White) (Archerfield, Early Muscat, Bowood Muscat, Charlesworth Tokay, Muscat Escholata, Ryton Muscat, Tottenham Park Muscat, and Tynninghame Muscat).—Bunches large, 12 to 18 inches long, loose, shouldered, stalk long; berries large, oval, uneven, footstalks long and

warted; skin rather thick, greenish yellow, becoming a clear golden amber when thoroughly finished, covered with a thin white bloom; flesh firm, crackling, very sweet, exceedingly rich, with a high Muscat flavour; leaves medium sized, slightly wrinkled, deeply lobed and serrated, dying off pale yellow mottled with brown; vine robust, and free bearing. This is the richest grape grown, equally valued for home use and market, and requires a high temperature to bring it to perfection. Its great defect is bad setting, but that is overcome by careful culture and artificial fertilisation. No grape is so affected by climate, soil and cultivation as this; hence its many synonyms.

IV.—SWEETWATER GRAPES.

These are characterised by sugary sweetness, pleasant juice, tender flesh, and thin skin. They consist mainly of early or mid-season black and white varieties, and are esteemed by everyone; their culture is easy, and they ripen freely.

BLACK HAMBURGH (Frankenthal, Garston Black Hamburgh, Hampton Court, Knevet's Black Hamburgh, Pope's Hamburgh, Red Hamburgh, Richmond Villa, Victoria Hamburgh, Warner's Hamburgh).—Bunches large, broadly shouldered, conical, compact, sometimes loose, well set; berries large, roundish oval; skin thin, membranous, deep blue-black, covered with a blue bloom; flesh rather firm, tender, very juicy, sugary, rich, and pleasantly flavoured; leaves medium sized to large, dying off yellow; vine vigorous, free, of moderately strong habit, and a free bearer. "The Black Hamburgh was imported from Hamburgh by John Warner, a London merchant, who lived at Rotherhithe, and cultivated a large garden, in which was a vineyard, in the early part of last century. It is from this circumstance that it takes its name of Hamburgh and Warner's Hamburgh" (Dr. Hogg). It succeeds under every form of vine culture, ripening against a wall, in favourable situations, in the open air as far north as York; it perfects its fruit in a cool house, and forces well. Taken all round, it is the best summer and autumn grape in cultivation, especially for forcing, and general crop; but does not as a rule keep well after November.

BLACK JULY (July, Early Black July).—Bunches rather long, small, cylindrical; berries small and round; skin rather thick, deep purple, covered with a blue bloom; flesh tender, juicy, sweet, and pleasantly flavoured; leaves small, some slightly, others rather deeply, three-lobed; vine free in growth, and an abundant bearer. It ripens well against a wall in the open air, but its flowers are tender and require protection. This is the earliest black

grape, and very suitable for a sunny wall in the open air.

BLACK PRINCE (Boston, Cambridge Botanic Garden, Pocock's Damascus).—Bunches long, sometimes 18 inches or more, cylindrical, occasionally shouldered, then regularly tapering, very handsome, stalk long; berries medium sized, oval, well set; skin thick, deep purplish black, covered with a thick blue bloom; flesh tender, juicy, sweet, with a sprightly flavour; leaves roundish, somewhat serrated, medium sized, dying off purple; vine vigorous and free in growth, hardy, and a good bearer. This variety colours well, and is superb in appearance. It succeeds in a cool house and is good for planting against sunny walls outdoors, ripening just before the Black Hamburgh, but it does not hang long without shrivelling.

MILL HILL HAMBURGH (Black Champion, Champion Hamburgh).—Bunches medium sized to large, shouldered, thickly set; berries medium to very large, bluntly oval or quite round, sometimes inclining to oblate, hammered; skin thin, deep black, with a thin blue bloom; flesh solid, tender, melting, juicy, sweet, vinous, and richly flavoured; leaves large, deeply lobed, pale green, flaccid, and sickly looking; vine strong, inclined to grossness, young wood soft and pithy, not ripening well nor fruiting freely. Such are the characteristics of this variety when grown in a border mainly outside, and composed of rich materials. In an inside border, composed of somewhat gravelly and firm soil, we have found the growth vigorous, the wood firm, and crops abundant. When represented in the best condition it is the noblest of black Sweetwater grapes.

BUCKLAND'S SWEETWATER (White).—Bunches medium sized to large, short, with broad shoulders, handsome heart-shaped, but not always well set ; berries large, round, inclining to oval ; skin thin, transparent, pale yellowish green, becoming pale amber when thoroughly ripe ; flesh tender, juicy, and sweet ; leaves medium sized, pale green, dying off pale yellow ; vine moderately strong and a free bearer. This early white grape succeeds under the same conditions as the Black Hamburgh, forming a good white companion, and is esteemed for exhibition. It is, however, quite secondary in quality, and loses its pleasant Sweetwater flavour in keeping, therefore is only useful as a summer variety.

DUKE OF BUCCLEUCH (White).—Bunches large, about 10 inches long, with broad shoulders ; stalk thick, rather gross and fleshy ; berries very large, roundish inclined to oblate, flattened at the ends, with a large style-point ; skin thin, pale clear greenish yellow, becoming a fine golden amber when thoroughly finished ; flesh very tender, juicy, rich, sprightly, and pleasantly flavoured ; leaves large, roundish, stout textured, only slightly lobed, but deeply serrated ; vine robust, producing soft, thick shoots. This variety is the noblest white Sweetwater grape. Its defects are : difficulty in establishing the vine, not showing nor setting fruit

freely, and liability of the fruit to be spotted. To overcome these a little patience needs exercising after planting, so as to get the vine well established, training the canes thinly, pruning on the long system, carefully fertilising the flowers, and preventing the deposition of moisture on the berries when ripening, by a gentle warmth in the hot-water pipes, and a little ventilation. It is best as an early summer fruit, grown in an inside border. When required for late summer use, say in August and September, the growth must not be started before April. Treatment the same as the Black Hamburgh, with a somewhat dry atmosphere when ripening.

FOSTER'S SEEDLING (White).—Bunches medium sized to large, shouldered, remarkably well set ; stalk rather slender ; berries medium sized, oval ; skin greenish yellow, becoming clear amber when ripe, occasionally russeted ; flesh tender, melting, juicy, sweet, and well flavoured ; leaves large, deeply lobed and serrated, rather downy, dying off yellow ; vine moderately robust, very healthy, and remarkably fruitful. It is a useful white grape, succeeding either in a heated or unheated house. Its freedom of growth and productiveness render it the most easily cultivated and the most certain cropper of all grapes.

V.—VINOUS AND THICK-SKINNED LATE GRAPES.

These possess a brisk vinous flavour, with varied degrees of sweetness, and have no decided characteristics of the preceding classes, each variety possessing some special peculiarity. A few of the more useful of the black and white varieties are described.

ALICANTE (Black) (Black Lisbon, Black Portugal, Black St. Peters, Black Spanish, Black Tokay, Espagnin Noir, Meredith's Alicante).—Bunches large, broadly shouldered, always well set ; stalk stout and short ; berries large, oval ; footstalk short, stout, slightly warted ; skin thick, tough, jet black, covered with a fine blue bloom ; flesh tender, adhering to the skin, juicy, brisk, and pleasantly flavoured after hanging until matured ; leaves large, thick, and downy on the under side, dark green above, ripening late and dying off yellow, occasionally tinged with red ; vine strong, with prominent buds, and when the wood ripens well it fruits freely. This is a showy grape, both in bunch and berry, easily cultivated, and hangs remarkably well in a cool temperature to February.

ALNWICK SEEDLING (Black) (Clive House Seedling).—Bunches large, bluntly conical, usually with a shoulder, and long ; berries large, roundish ovate ;

skin thick, tough, purplish black, covered with a fine blue bloom ; flesh firm, juicy, vinous, sweet and rich when well matured, with a sprightly pleasant flavour ; leaves large, wrinkled, deeply toothed, dying off yellow ; vine robust, wood long-jointed, ripening well, and bearing freely. This grape is very handsome and easily grown, but its berries require to be carefully set with pollen from a free-setting variety ; a good keeper, shrivelling rather than decaying. It succeeds under the usual treatment given to late grapes.

GROS COLMAN (Black) (Gros Colmar, Gros Kolner).—Bunches medium sized to large, moderate in length and broad, generally one shouldered ; berries very large, round ; skin thick, tough, adhering to the flesh, jet black, covered with a fine bloom ; flesh rather firm, coarse, juicy, austere rather than sweet, with an earthy flavour until matured by hanging, then it is vinous and agreeable ; leaves large, downy and somewhat rusty, ultimately assuming a reddish

hue ; vine vigorous, the wood ripening well and bearing freely. A very handsome grape, largely grown for late use and market purposes. It is easily cultivated, ripens fairly well in a mixed house started in March, but succeeds best in a Muscat temperature, and requires a long season to grow in, so as to have thoroughly ripened, perfect fruit.

GROS GUILLAUME (Black) (Seacliffe Black).—Bunches very large, sometimes 2 feet or more in length and breadth, broadly shouldered, tapering, compact and well set ; berries large, roundish ovate, or round ; skin thickish, tough, deep purplish black, covered with a fine bloom ; flesh tender, juicy, vinous, and, when highly ripened, sweet and pleasantly flavoured ; leaves large, rather deeply lobed and serrated, dying off dark purple, mottled ; vine very strong, young wood brittle, in loose soils sappy and pithy, ripening badly, but in firm soil stout, short-jointed, maturing well, with bold buds, then showing fruit abundantly ; otherwise it will not bear without long pruning. It succeeds in a "mixed" house started in March. To secure high finish in large bunches, the vine requires a free run of trellis, particular caution in cropping, a long season to grow in, and gentle heat from start to finish, making the most of sun heat ; it is a very handsome grape, hanging till February or March ; often misnamed Barbarossa.

GROS MAROC (Black) (Marocain).—Bunches medium sized, shouldered, tapering evenly, stalk stout ; berries large, ovate ; skin thick, deep purplish black covered with a thick blue bloom ; flesh firm, melting, juicy, vinous, and pleasantly flavoured ; leaves large, deeply toothed and lobed ; vine strong, ripening well, and bearing freely on young canes ; a fine-looking grape, colouring freely and perfectly. It succeeds under the same conditions as the Black Hamburgh, and is seen to the best advantage as an autumn and early winter grape.

LADY DOWNE'S (Black).—Bunches long, 9 to 12 inches, usually with one shoulder, closely set ; berries large, roundish oval ; skin thick, tough, membranous, deep purplish black, covered with a fine bloom ; flesh very firm, vinous, sweet, richly flavoured, with a "smack" of Muscat ; leaves medium sized, deeply serrated, downy, especially the stalks, dying off yellow, sometimes reddish ; vine strong, and free bearing. A valuable late-keeping grape. It succeeds in a mixed house started in March, assisted with gentle heat, but requires warmth when setting and stoning to prevent scalding, and a circulation of air to avoid scorching of the foliage on bright mornings. The

fruit may be kept in good condition till May and June.

WEST'S ST. PETERS (Black Lombardy, Money's St. Peters, Oldaker's St. Peters).—Bunches medium sized, tapering, well shouldered, freely set ; footstalks wiry ; berries medium sized to large, uneven, roundish oval ; skin thin, membranous, jet black, covered with a blue bloom ; flesh tender, very juicy, sweet, with a sprightly flavour, very refreshing ; leaves medium sized, wrinkled, deeply serrated, dying off purple ; growth vigorous, ripening well and bearing abundantly. A very fine late grape, keeping until March. It ripens fairly well in a mid-season house, but should be grown so as to have the fruit matured by September.

CALABRIAN RAISIN (White) (Raisin de Calabre).—Bunches large—12 to 18 inches or more long, tapering, slightly shouldered, rather loose ; berries large, round, free setting ; skin thick, transparent, whitish ; flesh rather firm, juicy, sweet, and pleasantly flavoured ; leaves medium sized, not deeply lobed, but somewhat freely serrated, dying off pale yellow ; vine moderately robust, healthy, and a free bearer. It is valuable for its late use and affords a pleasing contrast to black grapes. It may be grown in an ordinary heated house, and the berries remain firm until March.

SYRIAN (White) (Palestine, Jew's, Terre Promise).—Bunches very large, sometimes 20 inches long and as much across the shoulders, loose ; berries large, oval ; skin thick, greenish white, pale clear yellow when thoroughly finished ; flesh firm, crackling, sweet, and well flavoured when matured ; leaves large, deeply lobed and serrated, downy, dying off yellow ; vine robust, healthy and a moderate bearer. Speechly had a bunch at Welbeck, in 1781, weighing 19½ pounds, 21½ inches long, and 19½ inches across the shoulders. It is a good late grape, requiring plenty of space, thin disposal of the growths, and as much heat as Muscats. In an ordinary vinery it fruits fairly well, but the border requires to be stony and rather firm. In moderate heat it does not set very freely, and needs artificial fertilisation.

TREBBIANO (White).—Bunches very large, broad shouldered, well set ; berries medium sized to large, roundish oval, on stout footstalks ; skin thick, tough, membranous, greenish yellow, becoming pale amber when thoroughly finished ; flesh firm, crackling, juicy, sweet and pleasantly flavoured ; leaves large, deeply serrated, dying off yellow ; vine strong, but not gross, wood ripening well and a moderate bearer. It is a handsome late grape,

requiring a long season and plenty of heat to ripen it perfectly; then it will keep until March and April. Bunches of about 12 inches in length and 9 or 10 inches in breadth are the most useful, allowing the growths plenty of space, and not spurring too closely. It does not succeed well in an ordinary vinery, seldom having more than greenish-white berries, with a delicate bloom, and not characteristic in flavour.

WHITE NICE.—Bunches very large, with long shoulders, loose, setting freely; berries medium sized, round; skin thin, tough, membranous, greenish white, becoming pale amber when thoroughly ripe; flesh firm, juicy, sweet, and pleasantly flavoured; leaves large, downy on the under side, deeply serrated; growth vigorous, ripening well

and fruiting moderately. It is a showy grape, ripening (only later) in a house with Hamburgs, and remaining firm a considerable time. It requires ample space, and long pruning.

WHITE TOKAY.—Bunches rather large, 9 to 12 inches long, shouldered, compact, free setting; berries large, ovate; skin rather thick, greenish white, pale amber when thoroughly ripe; flesh firm, melting, and juicy, sweet and well flavoured; leaves large, deeply serrated; growth vigorous, ripening well, and fruiting freely. It is an old and fine late grape, but to keep well requires thorough ripening and a rather warm dry atmosphere, otherwise, like white Muscats, it falls a prey to spot. It succeeds in a mid-season house, ripening some little time after the Black Hamburg.

SELECTIONS.

FOR WALLS.

Black varieties.

* Black July
Black Prince.
Black Hamburg.

White varieties.

* Chasselas Vibert.
Royal Muscadine.
Early Smyrna Frontignan.
* Two best.

FOR UNHEATED HOUSES.

(Except in cold districts.)

Black varieties.

Black Prince.
Black Hamburg.
Madresfield Court.

White varieties.

Chasselas Vibert.
Early Smyrna Frontignan.
Foster's Seedling.

FOR A GREENHOUSE.

Black varieties.

Black Hamburg.
Madresfield Court.
Gros Maroc.

White varieties.

Chasselas Vibert.
Buckland's Sweetwater.
Foster's Seedling.

FOR A MIXED VINERY.

Black varieties.

Black Hamburg.
Madresfield Court.
Alicante.
Lady Downe's.

White varieties.

Buckland's Sweetwater.
Foster's Seedling.
Muscat of Alexandria.
White Tokay.

FOR EARLY HOUSES.

Black varieties.

Black Hamburg.
Madresfield Court.

White varieties.

White Frontignan.
Foster's Seedling.

FOR MID-SEASON HOUSES.

Black varieties.

Black Hamburg.
Mill Hill Hamburg.
Madresfield Court.
Meurthe Frontignan.
Gros Maroc.

White varieties.

Buckland's Sweetwater.
Duke of Buccleuch.
Foster's Seedling.
Dr. Hogg.

FOR LATE HOUSES.

Black varieties.

Alicante.
Gros Colman.
West's St. Peters.
Alnwick Seedling.
Mrs. Pince.
Lady Downe's.

White varieties.

Muscat of Alexandria.
White Tokay.
Mrs. Pearson.
Trebiano.
Calabrian Raisin.

FOR GENERAL USEFULNESS.

Early or mid-season varieties.

Black Hamburg.
Foster's Seedling.
Madresfield Court.

Late varieties.

Alicante.
Gros Colman.
Lady Downe's.

Muscat of Alexandria is not included, because it requires special treatment, whether grown for an early, mid-season, or late supply of fruit.

FOR HIGHEST QUALITY.

Muscat of Alexandria.
Dr. Hogg.

FOR LARGEST BERRIES.

Black varieties.

Mill Hill Hamburg.
Gros Colman.

White varieties.

Duke of Buccleuch.
Canon Hall Muscat.

FOR LARGEST BUNCHES.

Trebbiano.
White Nice.
Gros Guillaume.
Syrian.

FOR EXHIBITION.

Black varieties.

Black Hamburg.
Madresfield Court.
Gros Maroc.
Alicante.
Gros Guillaume.
Gros Colman.
Alnwick Seedling.

White varieties.

Duke of Buccleuch.
Buckland's Sweetwater.

Foster's Seedling.
Muscat of Alexandria.
Canon Hall Muscat.
Trebbiano.

FOR POT CULTURE IN UNHEATED HOUSES.

Black varieties.

Black Hamburg.
Madresfield Court.

White varieties.

Early Smyrna Frontignan.
Foster's Seedling.

FOR POT CULTURE IN HEATED HOUSES.

Black Muscat (Muscat Hamburg).
Gros Maroc.

Alicante.
Gros Colman.
Alnwick Seedling.
Lady Downe's.

Muscat of Alexandria and Mrs. Pearson may be grown with the pots placed on hot-water pipes.

FOR EARLY FORCING IN POTS.

Black varieties.

Black Hamburg.
Madresfield Court.

White varieties.

White Frontignan.
Foster's Seedling.

PROPAGATION.

The grape vine is increased by seeds, layers, cuttings, and eyes; also by inarching, budding, and grafting.

Seed.—New varieties are raised from seed through the agency of cross-fertilisation. To effect this it is essential to cut off the stamens from those flowers which are to produce seeds before they have ripe pollen, and when the stigma becomes fit pollen of the desired variety is applied to it with a small camel's-hair brush. To operate successfully a bunch should be set apart in a good position on the seed-bearing parent, cutting away all the flower buds beyond a dozen of the best before they expand, and enclosing the bunch in a thin muslin bag till the berries are swelling. The manipulations needed in cross-fertilisation will be found under "Setting." Choice of varieties for crossing must be left to individual taste, as no correct idea can be formed of the result of any cross, either as regards constitution or fruiting habit, form or size of berries, or of the colour or quality of the fruit.

The seeds should be taken from the berries when fully ripe, and either be sown at once or kept in sand until spring. They are preferably sown singly in small pots, covering them about $\frac{1}{2}$ inch deep in fine free loamy soil. The seedlings will soon appear in gentle heat. If several are raised in a pan they must be potted singly when they have two or three leaves, shaded for a few days until established, and then grown in all the light possible, shifting into larger pots as they require more root room, but 6-inch pots are sufficient to insure a strong plant, with plenty of fibrous roots for planting. Seedlings do not fruit early and freely in pots, but they can be inarched on the

young canes of established vines, and may then fruit in the second year. Planting in narrow borders, or budding or grafting on existing vines, are the usual methods of testing seedlings.

Layers.—A branch or thoroughly ripened cane placed in the soil before the buds start, secured with a peg and covered 1 inch deep with soil kept moist, will root freely and make strong growth the following year. Layering may also be effected in pots, as shown in Fig. 17, Vol. I., page 103, or a cane may be taken through the bottom of a 6-inch pot so as to have a bud or two above the rim, filling the pot with soil, keeping duly supplied with water, and detaching when well rooted.

Cuttings.—This is the usual method of securing outdoor vines, also stocks for grafting. The cutting may consist of two or three joints, Fig. 15, *d*, Vol. I., page 100, but in propagating from outdoor vines it is customary to take the cutting off with a heel, which is pared smooth, the buds cut out on the part to be inserted in the soil, leaving one or two at the top, and the whole length of the cutting 9 to 12 inches. The cuttings may be inserted where the vines are desired to grow. The only care needed to insure success is their insertion whilst dormant in free sandy soil, and watering in dry weather. Thus any cottager may procure a cutting of the desired variety, set it two-thirds or more of its length in the soil about 6 inches from his cottage wall on the south side, and in a few years embower the front of his dwelling with beautiful foliage, and have the satisfaction of eating the "fruit of his own vine."

"Eyes."—This is the method commonly practised in Britain and other countries where the grape vine is grown to afford fruit almost exclusively for dessert, and is the method pursued by nurserymen. Besides the economy of wood, which is an object in increasing new varieties, the root system secured is considered the most satisfactory, because the roots are originated at the surface, but it is not applicable to the propagation of the vine outdoors generally.

The eye or bud must be taken from firm thoroughly ripened wood of the previous year's growth, and the bud itself should be firm and round, not long and flat, as is found on gross and immature wood. The bud may be prepared for insertion as shown in Fig. 16, *k, l, m*, Vol. I., page 101, giving preference to the examples in the order there represented. Another method is to cut the cane through about $\frac{1}{2}$ inch above and below the bud, and take off a slice of wood about a quarter the thickness of the cane on the side opposite to the bud. This form of eye is represented in Fig. 74, *V*, page 245,

and has for its object the emission of roots emanating as near as possible horizontally, for spreading through the soil near the surface of the ground.

The eyes may be inserted early in February, or a little sooner, in 3-inch pots, efficiently drained a quarter of their depth. A suitable rooting medium consists of one half fibrous loam, a quarter of half-decayed leaf soil, and one-eighth each of fine charcoal and crystal sand. Press the mixture down rather firmly to within $\frac{1}{2}$ inch of the rim of the pot, then make a hole, introduce a little sand, press in the eye with sand under, around and over it so that the bud will be just level with the surface of the soil. The compost should be moist when used, and a light watering will settle the sand about the eyes. Pots or pans prepared in a similar manner can be used, placing a number of eyes in each, or the eyes may be inserted in cocoa-nut refuse mixed with a fourth of sand,

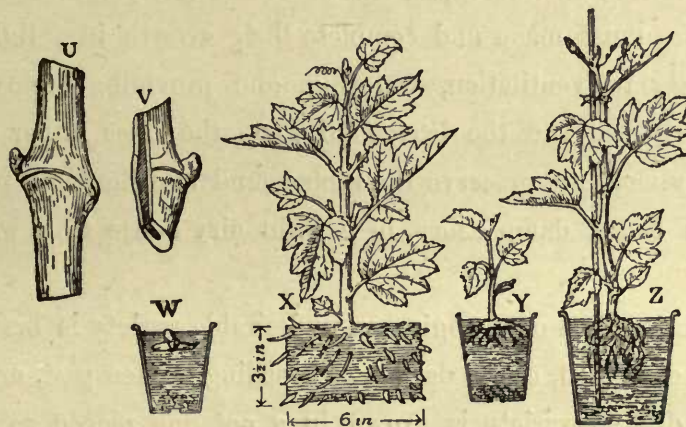


Fig. 74. RAISING VINES FROM "EYES."

References.—*U*, part of a cane with a bud. *V*, eye prepared for insertion. *W*, eye inserted in a 3-inch pot. *X*, growth from the eye or bud in turf. *Y*, cane from an eye inserted in a pan or bed, then potted off. *Z*, cane transferred from a 3-inch to a 5-inch pot.

in a propagating bed over bottom heat. When young vines are raised from eyes, for planting out the same spring as they are inserted, the eyes are pressed into turves about 6 inches square and 3 inches thick. The roots then are not coiled as in pots, and the breakage of a few roots beyond the turf on the removal of the vine from the bed increases the fibres and promotes sturdy growth—short-jointed wood, with leathery leaves after planting out.

The pots, pans, or turves containing the eyes should be plunged in a bottom heat of 75° to 80°, in a house with a temperature of 60° to 65° at night, 70° to 75° by day, with an increase of 5 to 10 degrees from sun heat, taking care not to over-water or the young growths may become "blind." When roots form and top growth is made to the extent

of a leaf or two, the strongest of the young plants raised in beds may be placed in 5-inch pots, the weaker in 3-inch pots, whilst those inserted in 3-inch pots may be transferred to 5 or 6 inch when the small ones are fairly filled with roots. They may be arranged on a bed or on shelves over hot-water pipes, where they can be trained near the glass or in all the light possible, syringing them in the morning and at closing time. A gentle bottom heat for about a month is helpful to growth. The cultivator should endeavour to secure a mass of fibrous roots, sturdy short-jointed growth, and well-ripened canes. Such may be obtained by using rather light gritty soil, without manure, feeding at the surface with phosphatic manure, stopping the laterals at the first leaf and to one joint of subsequent growths, and growing in all the light possible. The correct procedure in raising vines from eyes will be more readily understood from the illustration, Fig. 74, page 245.

The young vines must make and complete their growth in a light structure, due attention being paid to ventilation, watering, and providing atmospheric moisture. When thoroughly ripened and the leaves fall, keep the vines rather dry, yet the soil must be sufficiently moist to preserve the roots sound and the buds plump. They are best wintered on a bed of damp ashes, in a light airy house from which frost is just excluded.

Inarching.—This method of changing an undesirable variety is best performed when the first leaves are expanded, as the danger of bleeding is then past, and a speedy union is effected. The desired variety is grown in a pot and placed so that it is easily inarched on to the permanent vine, as represented in Fig. 23, *L, g, h*, Vol. I., page 135, and described on pages 136 and 137. A complete junction is effected in about six weeks, when the scion is detached just below its union with the stock.

The desired variety is placed in a suitable position and a slice of wood is taken from both shoots at a convenient place, forming a blunt tongue upwards in the stock and downwards in the scion, their cut parts exactly fitting; then bind together with soft matting, and shorten the stock shoot to a few leaves above the junction. When free growth indicates that the union is complete, cut the scion half way through on the outside, and loosen the bandage, otherwise a swelling takes place. If the scion receive no material check by cutting it half through, cut it completely off its own stem in a week, and remove the part of the stock above the junction.

Budding.—Budding the vine is practically “inlaying a piece of wood with the bud,” as shown in the two upper branches and lowest one on the right-hand side of the pear,

Fig. 23, *I*, Vol. I., page 135, and is useful in originating growths on bare stems. It may be performed when the stock is dormant, securing with a narrow waxed band, as described under "Grafting," and "Coating with Grafting-Wax," Vol. I., page 136; but a preferable time is when the stock has commenced growing, the cuttings supplying the bud-grafts having been retarded in a cool place. The growth of the stocks must be in advance of that of the scions. The preparation and insertion of the bud-graft is shown in Fig. 75, *A*, *g*, *h*, *i*.

Grafting.—For changing vines of old or unsuitable varieties to improved or desirable

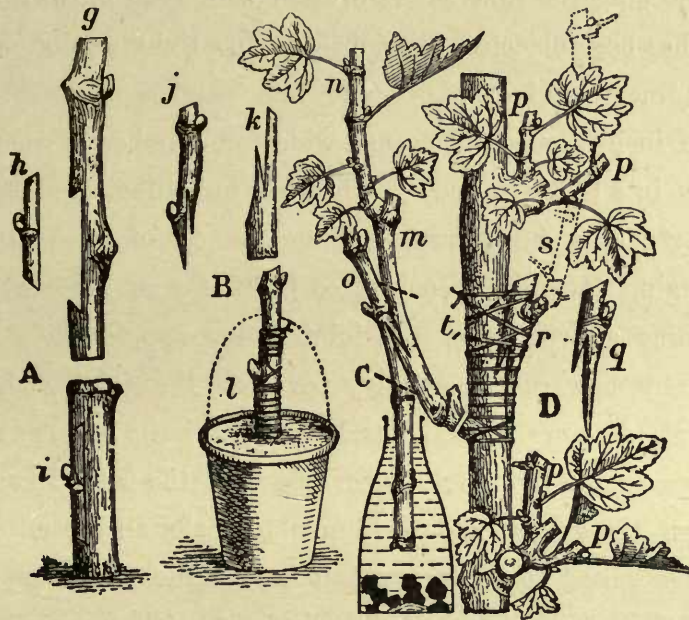


Fig. 75. BUDDING AND GRAFTING VINES.

References :—*A*, budding vine : *g*, cutting ; *h*, bud taken out ; *i*, bud inserted in the stock. *B*, dormant grafting : *j*, scion prepared ; *k*, stock prepared ; *l*, scion placed on the stock and bound—dotted lines indicate a mound of earth. *C*, bottle-grafting : *m*, one-year-old cane ; *n*, growth above the point of operating ; *o*, scion placed on the stock, with the base in a bottle of rain-water. *D*, grafting with one bud : *p*, growths retained to draw and utilise sap ; *q*, scion prepared ; *r*, scion inserted in the stock ; *s*, dotted lines indicate growth from the scion ; *t*, point of heading stock after the scion becomes established.

kinds, grafting affords a ready means, and is performed at different times—1, whilst the stocks are dormant ; 2, after growth has taken place in the shoots of the stock to the extent of half a dozen leaves. Dormant grafting is successfully performed on stocks of about the same size as the scions. The second method is best adapted to vines of considerable size, as it admits of changing the variety whilst the stock brings its current crop to maturity.

Care of the scions is of great importance, for, unless they are quite fresh yet dormant

when operating, success cannot follow. The cuttings intended for scions should consist of moderately strong canes, thoroughly ripened, taken from the vines as soon as the leaves have fallen, and laid in a trench on the north side of a wall, covering with sandy soil, where they will keep dormant until the latest vines are in a fit state to be grafted. Grafting is performed just before the sap rises in the stocks, March being the best month for those wintered in cool houses, as, if delayed until the buds commence swelling in the stocks, there is more trouble in checking the flow of sap from the wound. Whip-grafting, as shown in Fig. 75, *B, j, k, l*, page 247, is followed.

To prevent bleeding the junction is dressed with grafting-wax after binding with cotton, but this has been objected to as making too tight a joint, and wax bands are preferred in Continental vineyards. The wax band is made of soft coarse muslin cut into strips 8 inches long and $\frac{1}{2}$ inch wide. A number of these are dipped half their length only in a liquid formed by heating to boiling, in a shallow iron pan, $\frac{1}{2}$ pound each of beef tallow and beeswax, adding 2 ounces of resin, taking the strips out quickly and hanging them in a cool place till the wax hardens. The bandage is applied by beginning a little below the joint and wrapping the "dry" end closely, firmly, and spirally upwards, completely covering the joint, and, when the waxed portion is reached, drawing it tight and going spirally downwards and over the "dry" covered part until the whole is covered with the waxed band, gently pressing the joint between the thumb and forefinger to make all close. Waxed bands can be made in lengths suited to the size of stocks, or the scion may be bound with a dry bandage and then completely inclosed, air-tight, with the waxed cloth, or brushed over with shell-lac dissolved in alcohol, closing any exposed points. After binding, carefully cover the graft to the terminal bud with dry soil, as indicated by the dotted lines in Fig. 75, *B, l*, page 247.

Bottle-grafting (Fig. 75, *C*) is performed after the stock has commenced growth, selecting a short-jointed, well-matured shoot of the preceding year, with bold buds. Take a slice off near the middle, about 4 inches long, forming a tongue by a cut upwards with the knife as in whip-grafting; then take a slice off the stock and make a slit downwards to admit the tongue of the scion, and fit the scion on the stock as shown in Fig. 75, *C, o*. All the cut parts must fit with exactitude, and the binding with tape made secure. One or two buds are left on the scion, which must be of sufficient length for inserting in a bottle kept filled with rain-water and a few bits of charcoal, as shown in Fig. 75, *C, o*. The growth (*n*) attracts the sap into the scion

(*o*), and the descending current insures the speedy knitting of the two together. When the graft has grown 6 feet or more, remove the part of the stock (*m*) with a clean cut at the dotted bar, cutting off the end of the scion above the bottle as marked, and a cane of 18 feet or more in length will be produced the same season, whilst the vine carries its crop of grapes. This is an old and certain mode of grafting vines and other ligneous plants.

In Fig. 75, *D* (page 247), is represented side-grafting the vine on the main rod. The mode is "whip," but cleft-grafting in the side, as shown in Fig. 23, Vol. I., *I, a*, is eligible. The object in both is to give the scion a good grip of the stock by the tongue, so as to get new layers of wood extending well across the stock. In proceeding by either of these methods it is essential to have growth in the stock to the extent of the first laterals—about six leaves, and the scions should be placed in moist soil within the house for a few days prior to operating, so as to cause gentle excitement of the sap without starting the buds materially. Select some suitable part on the rod, the smoother and straighter the better, for receiving the scion, and cut the vine down to the spur immediately above, leaving one or more growing shoots with some leaves—in a weakly vine about the number shown in Fig. 75, *D, p*, and twice as many in a strong vine. Then prepare the scion (*q*), and place it on the stock, as shown in *r*, securing with the waxed bands already mentioned, or with tape $\frac{1}{2}$ inch wide, covering the whole except the bud; also cover the tape with grafting-wax. In a fortnight the scion will have "knit" with the stock and growth be issuing from the bud; then check the growth in the stock shoots, and in six weeks the union will be complete; the bandage may then be removed, and the rod cut away above the junction at *t*. The cane (*s*) may grow 20 to 40 feet in the season, and produce fruit the following year.

Weakly-constituted varieties are improved by grafting on hardier stocks, say the Black Muscat on the Black Hamburgh, and Frontignan on Foster's Seedling, whilst the shy bearers, such as Gros Guillaume, are rendered more fruitful by grafting on free-bearing varieties, such as the Black Hamburgh and Muscat of Alexandria.

SOIL AND BORDERS.

Soil.—The vine flourishes in a gravelly calcareous soil, producing grapes rich in flavour; the wine has a full body, and possesses a rich bouquet. In alluvial soils the vine is strong, the grapes large but coarse in flavour; the wine is harsh, yet full bodied, and improves by keeping. Where the soil is not gravelly (silici-calcareous)

the grapes are indifferent in quality and the wine is inferior. These remarks have special reference to the open-air cultivation of the vine in the southern and western parts of England, on warm slopes or sunny walls.

In many localities the natural soil of this country is as well suited to the grape vine as that of the best wine-producing countries, but our gravelly soils are poor in potash. It is easy, however, to make soil capable of producing the finest grapes by a judicious admixture of inexpensive materials. But due regard must be had to the mechanical state as well as to the chemical composition of borders for vines. The soil must be permeable by the roots and be sweet, so as to admit of a steady assimilation of the nutrient elements, and preserve the roots in a healthy state. Right and wrong procedure in the preparation of soil for vines are shown in the illustration on the next page.

From *E*, Fig. 76, we learn that the soil must be gritty enough to allow water to readily percolate and pass away, yet so compact as to insure the breaking up of the roots into numberless fibres. In *F* the border was a mass of organic matter, settled into a close sour staple, unsuitable for fibrous roots, and rendered poisonous by an excess of liquid manure and heavy mulchings. It was wet and cold, and the roots sought the most aerated part, namely, the rubble. The mechanical composition of the border is, therefore, of paramount importance for securing a maximum of roots, and these should be so fed as to produce grapes at a minimum of expense.

Preparation of Natural Soil for Outdoor Vines.—Sandy or gravelly soils, with the subsoil free from stagnant water, only need stirring to the depth of the good soil, and the subsoil loosening, with a judicious admixture of clay, dried and pounded, the amount varying from one-third to one-sixth, according to the departure from a friable loam. Very brashy silicious soils are best improved by clay marl, to supply lime, potash, and other mineral substances. A depth of 18 inches is ample for outdoor vines. To secure this, one-fourth of clay soil or clay marl means $4\frac{1}{2}$ inches mixed with $13\frac{1}{2}$ inches depth of natural soil; one-fifth, $3\frac{1}{2}$ inches with $14\frac{1}{2}$ inches; and one-sixth, 3 inches with 15 inches. It is inadvisable to incorporate manure with the soil, as it tends to luxuriance, and the cultivator's control over the growth is the greatest when manurial dressings are restricted to the surface.

Stiff soils contain abundant supplies of vine food, but practically sealed through lack of drainage and aëration. It is not always easy to drain a low site, but borders can be made above the surrounding level. Remove the good soil, lay it aside, and mix with it broken sandstone, the largest particles being the size of a hen's egg, old

mortar, stony road-scrapings, cinders, or burned clay, so as to form a friable compost. Let the excavation have a slight incline to a drain in front, and concrete the bottom to a depth of 4 to 6 inches, then place in a foot in depth of drainage, formed of brick-bats or other hard material, the roughest at the bottom, the finest on the top, which cover with turves, and then place on the compost to a depth of 2 feet. Where drainage is not practicable, the border may be made wholly on the surface.

Borders for Vines under Glass.—The foregoing remarks are also applicable to vines in glass cases or greenhouses, and the roots entirely in outside borders. For special culture in vineries richer soil is needed; therefore light soils may have decayed cow manure, and heavy soils sweetened manure from horse stables, thoroughly incorporated with them.

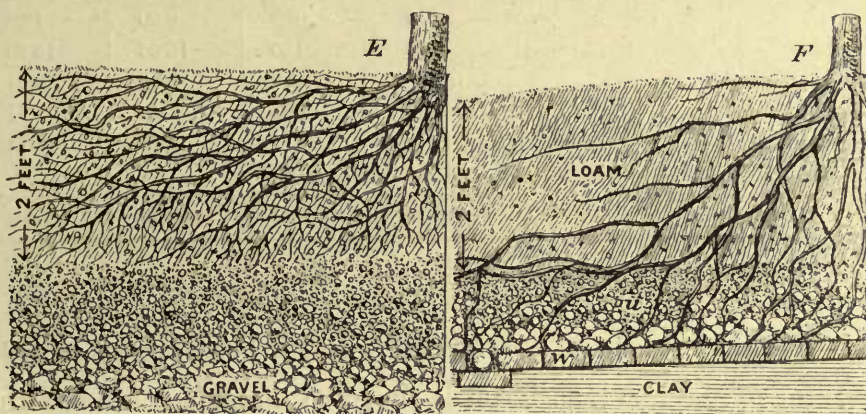


Fig. 76. - VINE ROOTS IN A GOOD NATURAL GRAPE SOIL, AND IN AN UNSUITABLE ARTIFICIAL BORDER.

References:—*E*, section of a gravelly soil (oolite), showing vine roots in the natural soil. *F*, artificial border, showing vine roots in the drainage instead of the loam—the top 2 inches of an old pasture, with a sprinkling of $\frac{1}{2}$ -inch bones: *u*, drainage; *v*, drain; *w*, bricks on flat, with joints run with cement.

Good garden soil, properly enriched, stirred, and well drained, will produce fine grapes, but most grape growers prefer fresh loam for making new or renovating old borders.

The soil generally selected is the top 3 inches of an old pasture. If the herbage is close, and sheep thrive upon it, the staple is considered perfect as a lightish soil; when the grass fattens oxen, the soil is deemed specially suitable as a heavy medium. The former answers for vines in pots, and those grown to supply early grapes; but the latter finds most favour with growers for the stronger, larger, and later varieties. The staple, however, varies, so that substances are added to the loam to give it the desired mechanical texture. The top 3 inches of a deer-park, sheepwalk, or old pasture is peculiarly suited to vines, because food has accumulated through the growth of gramineous and leguminous plants, though well-conditioned arable land

is also suitable for grape production, and its mechanical texture is often better than borders formed of turf. The subjoined table shows the composition of soils suited to the wood of vines, also the skins and stones of grapes.

Constituents.	Soils.		Wood of Vine.	Skins of Grapes.	Stones of Grapes.
	Rather light.	Rather heavy.			
Organic matter * and loss on heating ...	4·030	6·140			
Oxide of iron	4·154	4·700	·16	1·97	·65
Oxide of manganese ... ..	..	..	..	·51	·45
Alumina	2·986	3·980	..	..	..
Lime	1·420	2·040	30·28	21·73	35·61
Magnesia	·552	·605	6·55	4·45	8·51
Potash	·283	·530	34·13	46·83	29·48
Soda	·010	·035	8·00	1·62	..
Phosphoric acid	·085	·130	16·35	15·66	21·07
Sulphuric acid... ..	trace	·050	2·66	3·81	2·61
Chlorine	·004	·008	·42	·71	·35
Silicic acid (silica) ... ..	..	..	1·45	2·71	1·27
Insoluble silicates and sand	86·476	81·782	..	..	..
	100·000	100·000	100·00	100·00	100·00

* Containing nitrogen ... ·150
Equal to ammonia ... ·180

·170
·210

Loam for vine borders should be yellowish, with a brown crust caused by humus and the oxidation of the iron; such soil is found on limestone. Loams from the Old Red Sandstone and the New Red Sandstone give healthy vines which continue fruitful over a longer period. Such soils must not be too light, nor too heavy, but of medium texture. Take a small handful and squeeze it when moderately dry; if it fall like powder when the pressure is relaxed it is too sandy; if it squeeze into a plastic mass, and does not fall when the ball is gently pressed on the apex, but becomes indented by the fingers and retains its form, the soil is too clayey; but if the handful so squeezed preserves its ball-like form, yet crumbles when gently pressed, the soil is of medium texture. If too clayey, add old mortar, brick rubbish or burned clay; if too sandy, supply the necessary amount of pounded clay. When calcareous matter is deficient, mix chalk with light, and calcareous gravel with heavy, soil.

Of the ingredients usually added to turf in preparing a compost for vines a brief review may be useful. 1, Fresh horse-droppings stimulate root activity when decaying, supply humus and leave interstices for air. Large quantities of stable or farmyard manure tend to foster fungi when dry and cause an excess of moisture when wet—a close, soapy, inert mass. 2, Lime rubbish acts mechanically and chemically, by keeping

the soil open and supplying lime for nitrification. 3, Wood ashes furnish potash, magnesia, and other mineral elements. 4, Charcoal absorbs ammonia, retains large quantities of gases in its pores and yields up the elements again as plant food, increases the power of the soil to absorb heat and renders it more friable. 5, Fish refuse provides nitrogen, phosphoric acid, and magnesia, yielding the substances rather slowly. 6, Oyster-shells, whole or crushed, act mechanically and chemically, keeping the soil open and furnishing lime. 7, Horns and hoofs—parings or refuse—decompose slowly, and supply nitrogen. 8, Bones, coarsely crushed, furnish phosphate of lime, nitrogen, and phosphate of magnesia with a little soda. Soot contains ammonia salts.

Some of the foregoing ingredients are generally intermixed with the loam in forming a compost for vine borders, but the need or otherwise of them must be determined by analysis or individual judgment. Four recipes for the guidance of beginners are subjoined.

FORMULÆ FOR BORDERS.

Materials.	Cart-loads.	Cart-loads.	Cart-loads.	Cart-loads.
Turfy loam of medium texture... ..	(1) 20	(2) 12	(3) 10	(4) 5
Fresh horse-droppings	1	1	1	1
Old mortar or lime rubbish	2	2	2	1
Wood ashes, dry ... ..	..	..	1	1
Charcoal, nuts	1	1	..	..
Fish refuse, heads, &c.	1	..	..	..
Oyster-shells, whole or crushed	2	..	cwts.	..
Horns and hoofs, shavings	cwts.	cwts.	2	cwts.
Bones, crushed, 1 inch down to $\frac{1}{2}$ inch	10	5	4	3
Soot, dry ... ..	..	..	..	3

A cartload of loam contains about ten barrow-loads of about 3 bushels each. The proportions of the several ingredients may, therefore, be readily calculated so as to meet every requirement. All the mixtures have proved excellent—1, sound, durable, suiting all varieties, including Frontignans and Muscats; 2, open, suited to liquid feeding or a heavy rain-fall, midseason and other crops; 3, adapted to all varieties and cultures, first propounded by Mr. W. Thomson; 4, suitable for the hardier and coarse varieties.

It may be added that formula No. 2, the border 3 feet deep on a bed of gravel, gave, with otherwise good management, by the late Mr. James Dickson, at Arkleton, Dumfriesshire, the following extraordinary results in the production of heavy bunches of grapes during seven consecutive years. In 1869 the largest bunch he exhibited weighed $16\frac{1}{2}$ pounds; 1870, 19 pounds 5 ounces; 1871, 18 pounds 7 ounces; 1872, 19

pounds 6 ounces; 1873, 16 pounds 1 ounce; 1874, 16 pounds 10 ounces; and in 1875 the monstrous bunch represented on page 236 weighed at Edinburgh 25 pounds 15 ounces, so it seems to have lost weight on the way. This is an achievement unparalleled in the history of grape culture, and as such is worthy of record here.

The loam, called turf, should be cut 3 inches deep with a spade, or be ploughed up when the ground is in good working order. Never handle it in very wet weather. It may be placed in narrow ridge-roof stacks when not required for immediate use, sprinkling quicklime or soot on each layer of turves when there is a suspicion of wire-worms (see Vol. I., page 277). Turf, however, may be carted direct to where it is wanted, and be used forthwith with the other ingredients in the border.

Vine roots extend to a considerable distance from the stem in favourable soil; some have been found more than four times the distance from the stem the branches extended. Where the natural soil is suited to the vine there is a manifest advantage in allowing the roots to have a free run, as they then find sufficient nourishment for the crops. When the roots are restricted to a fourth the extent of food-supplying area the grower must furnish ample nutrient elements or the vines will languish. Thus vines in a narrow border need more manure than do others in a wider one, the branch area being equal in both cases.

Instead of extensive inside and outside borders made all at once, it has been found more satisfactory to provide a narrow border only to plant the vines in, adding strips of fresh compost annually, or, as more root space is needed, continuing the procedure till the border is fully made; then maintain the vines in health and fruitfulness by top-dressings, partial renewals of the border and, after a time, complete renovation. Some growers, however, make the border the full width at once, crop the vines heavily, feed highly, and clear all away when exhausted. It is the most economical to make the border piecemeal where the soil is unsuitable, to manure heavily where the soil is mechanically correct, crop the vines to their full capacity consistent with the perfection of the fruit, and when they are no longer profitable, supplant them by young vines, instead of rejuvenating the old by expensive border renovation. These are matters upon which growers must exercise judgment.

The structures to be devoted to vines often have the interior so arranged for plant growing that it may be difficult to make a suitable border inside. There is no necessity for an inside border when it is not desired to have very early grapes. Most greenhouse vines are better with the roots outside than inside the house, for with the roots

exclusively inside they rarely have water enough during growth, whilst in winter the border may be soddened with the drip from plants in pots. The rain-fall in most places and seasons is ample for outdoor vines, while with the border properly drained and composed of suitable materials, there is little danger of an excess of moisture at the roots from heavy rains. With the roots entirely inside there is danger of the vines not receiving sufficient water and nourishment for the perfection of their crops. We, therefore, advise outside borders for greenhouse vines, also for all hardy-constituted varieties that are not forced early, and from which the crops are removed by or before Christmas.

Except for early forcing, Muscats, and varieties of peculiar constitutions, the borders should be partly inside and partly outside. This affords facilities for renovating them without prejudice to the crops, reduces the need of water one half, and the roots have the option of running in the warm inside or the colder outside border. In the early part of the growing season the roots are the most active in the inside border, but later they make the greatest progress in the outside one. If a vine is given the choice of an equal extent of inside and outside border it prefers rooting in the latter. This is partly due to the difference in the moisture, but in greater measure to the outside border having the benefit of the sun's rays whilst the inside border is shaded. The covering of vine borders with thick coatings of manure in winter and spring must be prejudicial. Vine roots need air to continue healthy—at least, air is needed for the proper assimilation of plant food in the soil, and thick coverings of manure hinder the sun from warming the border, the roots of vines not becoming active until the soil has a mean temperature of 50°. (See "Aërial Roots.")

Upon the foregoing considerations we conclude—1, For early forcing Muscats and Frontignans the roots should be confined to inside borders; 2, midseason and late grapes, except varieties of peculiar constitution, should have part inside and part outside border; 3, midseason and late varieties of hardy constitution succeed in outside borders; 4, where the soil is mechanically right and the drainage thorough no special border is needed.

Raised Borders.—These are the means of securing perfect drainage, dryness, and warmth in low-lying situations and cold, wet, clayey soils. Retaining walls are necessary for outside raised borders, and should bevel inwards to prevent bulging, the side wall be 1 foot lower than the front wall of the house so that the border will incline to the sun, and all the walls have brick-on-edge capping built in cement. Burrs, clinkers, or stones may be placed against the border in rockwork fashion instead of a retaining wall. The

drainage rubble should commence with the surface level; the soil then cannot be waterlogged.

Aërated Borders.—Advantage is sometimes taken of raised borders to leave openings here and there in the retaining wall to admit air to the drainage; then upright pipes, 6 to 9 feet apart, passing through the soil and above it, with a wooden plug for closing each pipe, are fixed. This system is useful on warm days in increasing the temperature of the border, but the assumed aëration is the wrong way about, and, unless very complete in action, neutralises the good offices of the rubble by allowing a circulation of air other than through the whole border. Indeed, a body of air in the interstices of the drainage kept still acts beneficially on the soil in maintaining warmth, and the air that follows each supply of water aërates, sweetens, and purifies the border.

Heated Borders.—These have been advocated, adopted, and abandoned as not conferring benefit proportionate to the outlay. Muscat of Alexandria grapes may be grown successfully in outside borders, heated by hot-water pipes in chambers beneath, yet the crops do not excel those produced by vines in inside borders without bottom heat. Heated borders are sometimes requisitioned in very early forcing, the vines being planted out, grown to a fruiting size, matured early, and started so as to ripen the crops in March or April. (See "Vines in pots.")

Site.—Although grapes are produced almost everywhere, the crops are better in some localities than in others. In flat, low-lying, damp districts vines are subject to grossness, imperfect maturation of the wood, and more liable to attacks of mildew than in higher and drier locations. The situation for vines must be open, no trees or buildings obstructing the light at any part of the day. Vines succeed on east and west aspects unshaded by neighbouring objects, but it is on the sunniest slopes, where the drainage is perfect and the soil good, that the most luscious grapes are produced. The border also requires sun and air as much as the vines. North borders that receive little sun, soil beneath stages kept dark by the shade and soddened by the drip of plants, are not the places best calculated to furnish food to maintain vines in health and fruitfulness. Yet it is in the soil and through the roots—their size, number, and character—that the foundation of early and permanent fertility is truly laid.

Border Dimensions.—A border 3 to 4 feet in width will support vines with three times the foliage superficies, and good crops of grapes can be secured for a number of years by recourse to top-dressings and renewal of the soil. Such widths of border answer very well for houses 7 feet 6 inches to 9 feet wide, but the border, as a rule, should

correspond in dimensions with the roof or trellis superficies; that is, the width and length of the border fully formed should equal those of the house. This amount of root space serves vines, with judicious feeding and top-dressing, a lifetime, due regard being had to proper management and cropping. When vines are given the run of outside as well as inside borders it is a good rule to apportion the root space equally; say, in a house 20 feet wide, make 10 feet of inside border at three times, and 10 feet of outside border at other three times. Each section of border will serve the vines at least one, and with judicious feeding and top-dressing two years, so that the vines are amply provided for for twenty-one years at least, and their fruitfulness can be prolonged by renovating the border. This amount of border space we find better than a larger one because more likely to be properly made, duly attended to, and better occupied with active food-imbibing roots. Large masses of soil are not necessary, and in the case of artificial borders undesirable.

When the natural soil and substratum are unsuited to the vine, the border should be concreted at the bottom, and on that walls built so as to restrict the roots to the space provided. The concrete should fall not less than 1 inch in 3 feet to the drains, and these must communicate with land drains outside the border, and on a lower level. It is not a good plan to have drains nearer the place of planting the vines than 3 or 4 feet on each side. This is of moment in lifting vines, especially when it is necessary to renew the drainage. We prefer to have the drains about 9 feet apart longitudinally of the house in preference to relying on a single drain in the front of the border. The excavation is best made the whole width of the intended border, so that the concreted bottom and retaining walls can be truly laid and built. The inside border, of course, can be provided for first, continuing the concrete through the arches when there is to be an outside border as well, afterwards bricking up the openings, for the inside border must be well occupied with the roots of the vines before they are admitted to the outside border, which need not be prepared until required.

Drainage.—Observations on soil and place for growing grapes successfully have been given with a view to safe guidance. Provision has been made for carrying off superfluous water, yet it is well to make sure that the system of drainage insures abundant aëration. Clean rubble-stones or brickbats—not less in size than the doubled hand—should be placed at the bottom of the border 6 inches deep, then 3 inches in thickness of pieces about half the size, and on them an even 3 inches of material the size of road metal, every particle of fine being sifted out. Old mortar and brick

rubbish answers well for the top layer. The drainage may be deeper—it ought not to be less than 12 inches—and a thin layer of reversed turves upon it will make all safe and sound for no one knows how long.

Making the Border.—This is best effected a short time only in advance of planting, for considerable warmth results from the fermentation that issues on the putting together of turf in quantity, and lasts the greater part of the season. The turf may be cut in squares ranging from 2 to 6 inches, with sufficient loose soil to allow of the whole incorporated ingredients being put together evenly, compressing gently with a four-pronged fork, so as to make the mass compact. With the compost moderately moist and firmed as advised, little settling will take place, but if put together lightly the border will sink considerably. That, however, is not the right way to make a border for vines.

When the ingredients used with the turf are few, the latter need not be broken up, but packed as closely as possible, grass side downwards, filling all crevices with the loose soil that breaks off the turves during removal, giving special attention to the sides of the walls, where there is apt to be a crevice such as might take away much of the water given to the vines. During the process of building up the turves a few crushed bones or other ingredients are sprinkled on. Borders put together in this manner have a good mechanical action, and the continuous decay of the vegetable matter furnishes the stimulus to free growth which characterises vines planted in fresh turf, but in a few years that mechanical action ceases, and the mass becomes simple loam. Hence the necessity of providing materials that will render the texture of the border permanently friable.

The depth of the border ought not to be less than 2 feet. Shallow borders need large supplies of water to insure proper moisture when the vines are in active growth, and, unless the water or liquid manure correspond to the temperature of the soil, the roots are frequently checked, which prejudicially affects the health of the vines, and the swelling and perfecting of their crops. The depth of soil named answers well for varieties of moderate vigour. Free-growing sorts, such as Black Hamburgh, have all needs provided for in 27 to 30 inches depth. The strongest varieties do not require much more than that. Three to 6 inches more in depth may, however, be allowed where the soil is light, or the rain-fall low, 12 inches or less for the summer months (April to September inclusive). Correspondingly less depth is needed where the soil is strong, or the rain-fall high—18 inches or more during the summer months. Growers must exercise judgment.

PLANTING.

Two descriptions of young vines, called “canes,” are employed for planting—1, young growing canes raised the same season ; 2, ripened canes of the previous season’s growth.

The first method can only be practised in inside borders. Vines raised from eyes in the way described on page 244 can be planted out in May or June—preferably before midsummer—in the places they are to occupy, having inured them to the air of the structure for a few days before planting. The young vines need not have been grown in larger pots than 6 or 7-inch pots, and from these they should be planted with the ball entire, pressing the soil of the border against it as firmly as possible without injuring the roots. If the border consists of turf closely packed it should be chopped up where each vine is to be planted, about 18 inches wide and a foot deep, a little older soil, such as will crumble, being mixed with it. With the soil from the pots, also that of the border, moist, water should not be given immediately, but the vines damped ; also shaded for two or three days from sunshine ; but if the soil be rather dry, afford a supply of tepid water. The vines will commence growth immediately



Fig. 77. VINE FOR INDOOR PLANTING. (From *The Journal of Horticulture*.)

and, under good management, make canes 20 to 30 feet in length, stout and firm, the first year. In the pot system of raising the plants the roots are more or less spiral, but these do not form the after-rooting system, as fresh roots push so fast from the collar or base as to overpower them, the vine roots spreading horizontally, or slightly inclining

downwards, through the border. The turf system (Fig. 74, X, page 245) prevents a corkscrew formation, secures abundance of fibrous roots, communicating by direct channels with the stem, instead of nourishment having to reach it by tortuous routes, as when the roots are spiral.

Ripened canes of home-raised vines may be planted in September; those from a nursery in October. Such, with the leaves ripening, take to the soil at once, and push adventitious roots ready to transmit nourishment directly the buds start the following season. If planting cannot be performed before the leaves fall in the autumn, it is better to defer it until spring than to plant in mid-winter. Indoor planting may be practised from the end of January to April, according to the time of starting the vines; but it is not wise to plant in an outside border with the ground at a temperature of 38° to 45° , and introduce the canes into a minimum heat of 55° . The better system is to wait until the outside border has a temperature favourable to the vines rooting, and that is easily ascertained by plunging the pots in the soil where the vines are to be planted, and when the buds commence swelling it is certain that there is a reciprocal action between the part above ground and the roots. The vines may then be planted.

The canes should be procured and shortened to the required length before January, for they cannot be safely pruned much later. Shortening, however, is sometimes delayed from unavoidable causes, and bleeding ensues when the sap rises. This may be averted by dressing the cuts, when dry, with painters' "knotting," and it can be arrested by allowing the temperature to fall as low at night as is safe, which causes the sap to recede, when the wounds should be wiped dry, and well dressed with "best French polish." Whatever sap afterwards exudes thickens and closes the pores of the wood. When shortening has been postponed until planting time, it is a good plan to plant with the cane entire, and when growth has taken place to the extent of a leaf or two, commence disbudding the upper part, and gradually down to the shoot or shoots it is wished to retain, ultimately cutting the useless part of the cane away, as there is no danger of bleeding when the vine has foliage to utilise the sap.

Young vines with ripened canes should have the soil shaken away, or, when this cannot be done without bringing some roots away also, the ball should be soaked in tepid water, the soil washed away, and the roots carefully disentangled. A planting vine, as grown and prepared for planting by Mr. D. Thomson, is shown in the engraving, from a photograph, Fig. 77, see preceding page.

Attention is particularly directed to the fibrous root system, the number of feeders

being enormous, whilst there is no paucity of long roots for spreading through the soil to some distance from the stem, and so giving them an extensive area from which to

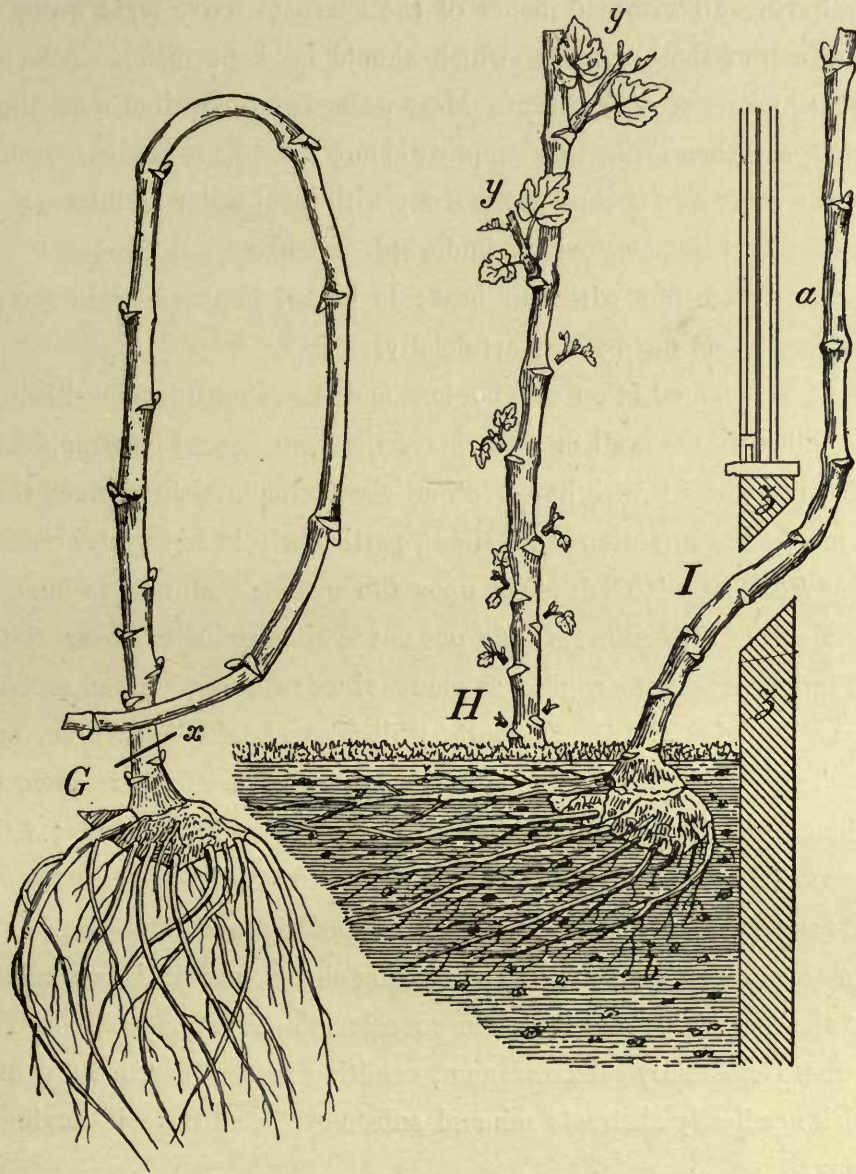


Fig. 78. PLANTING VINE, TERMED A "CUT-BACK"; DISBUDDING; PLANTING IN OUTSIDE BORDER.

References :—*G*, a young vine, shortened for planting; *x*, point of pruning a "cut-back" (planting cane) for growing into a "fruiter," or securing a strong cane from the base. *H*, disbudding cane: *y*, growth when safe for disbudding—lower shoots detached. *I*, cane planted in an outside border, eyes taken out: *z*, wall; *a*, vinery or greenhouse; *b*, border.

gather and transmit nourishment. A planting vine of the usual kind, turned out of a 9 or 10-inch pot, and the soil shaken away ready for planting, is represented in Fig. 78.

In planting, the roots should not be exposed to the drying influences of the atmo-

sphere, but promptly spread out evenly and fully, laying them near the surface in layers with soil between them, making all moderately firm, covering the uppermost roots 2 inches, and having all within 6 inches of the surface. Give tepid water, and mulch with about an inch of short manure, which should be kept moist. Avoid saturating the soil, as that hinders root formation. More water is not required until the vines commence growing, and then it must be supplied before the foliage is distressed. A gentle sprinkling of the canes two or three times a day with tepid water facilitates a good break, and, with a genial atmosphere, vines under glass make good progress. Growth is stimulated by early closing with sun heat; in heated houses a night temperature of 50° to 55° is ample, and 65° by day artificially.

When vines are planted in outside borders, and the canes introduced into a structure through an opening in the wall or elsewhere, the stem should be wrapped with a hay-band, and the space closed with hay or other elastic material to protect the stem from frost. This must have attention at all times, particularly in the winter season.

Distance of Planting.—This depends upon the mode of culture to be pursued, and the object in view. Some growers only put out a single vine to cover the south wall or gable of a building; others employ as many vines to cover a given extent of trellis, under glass, as the rods are trained apart; whilst some take two, three, or more rods from a vine. Taking the rods to represent vines, the distance for permanent ones should not be less than 3 to 4 feet for the weaker growers, such as Frontignans; 4 to 5 feet for the vigorous varieties, such as Black Hamburgh; and 6 to 7 feet apart for such robust-growing sorts as Gros Guillaume, Muscat of Alexandria, and Trebbiano. This allows space for the proper development of the bearing shoots, and it is an axiom in grape growing that the more space and light vines receive, the finer the grapes. Yet allowing more space than is necessary is extravagant, resulting in the manufacture of an excess of wood, which needlessly abstracts mineral substances from the soil, having eventually to be cut away.

Close planting cannot be successfully practised without leaving the lateral growths very thinly disposed on the rods. It is best to afford ample space, even if temporary vines are planted midway between those that are intended to remain productive for a number of years. The supernumeraries are fruited in the second and subsequent years to their fullest capacity consistent with the perfecting of the crops, and are cut out as the permanent vines require the space. Thus early returns are secured with little prejudice to the chief vines, which need to become thoroughly established before fruiting, and

must not be heavily cropped in their early years, nor at any time over-cropped, if they are expected to be permanently satisfactory.

OUTDOOR CULTURE.

Vineyard.—Except on sunny slopes and in gravelly soils in the southern parts of the Kingdom, the cultivation of vines to produce grapes for making wine is not practicable. Southern slopes too steep for fruit culture generally might be utilised for growing grapes, by forming terraces, for banks of earth often secure as much warmth as walls do. But it is little use attempting grape growing outdoors (or anywhere else) without attending to their cultivation, disbudding, stopping and thinning the growths, keeping down insects and fungi, and thinning and taking care of the fruit. Rich garden soils and deep loams do not assist, but retard, grapes ripening in an unfavourable season.

The vineyard must be open to every ray of sun; hill or rock shelter is better than that of woods; the soil should be gravelly or sandy, and thoroughly drained. The growth of the vines will then be firm and the grapes richer than in deep loams. Avoid manure in the soil, but use it on the surface as necessity arises for imparting vigour to the vines.



Fig. 79. A CASTLE COCH VINE. (From *The Journal of Horticulture*.)

The Black Cluster, Miller's Burgundy, and Gammé Noir are perhaps the best varieties for wine-making. The last named is chiefly grown at Castle Coch, near Cardiff; it has small round berries, blue-black when ripe.

Arrangement and Planting.—Vineyards are generally planted in lines running north and south. At Castle Coch the vines are placed 3 feet apart every way, and the growths are secured to upright stakes, rising about 4 feet from the ground. A vine so trained is represented in the illustration, Fig. 79, page 263.

In raising outdoor vines it is a common practice to “set” the cuttings in their final quarters, leaving two eyes above ground; but one suffices (page 100, Vol. I.). Rooted canes should be planted in autumn, mixing a handful of bone-meal with the soil for each vine and cutting the cane back to two buds.

Training and Pruning.—Castle Coch system. In this the vine has a main stem of 9 to 12 inches, and the bearing shoots proceed from the top. These are secured to the stake already mentioned, and are cut back to a bud or two of the base every season. Several growths start in spring. A selection is made of the most promising for bearing, and the others are rubbed off. Three are shown in the engraving

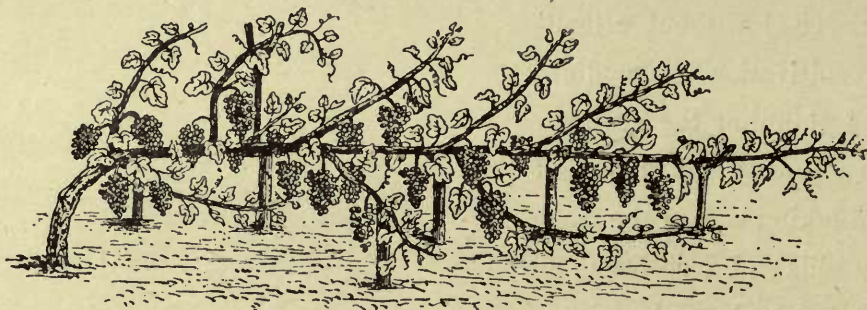


Fig. 80. VINE ON CHAINTRE OR EXTENSION SYSTEM (AFTER WETMORE.)

(Fig. 79, page 263), a leaf or two having been removed to render the grapes more visible. The bunches are produced from the third or fourth joints from the base, but the shoots are allowed to reach the top of the stakes, and are then stopped. Secondary growths are suppressed as fast as produced, that letting the sun reach the ground, which, kept free of weeds, absorbs heat and in turn radiates it in cold periods, and conserves the soil's moisture.

Chaintre or Extension System.—This originated with the French, and “consists in growing long canes which, when fruiting, are supported upon short forked stakes, so that the clusters hang within a few inches of the ground.” It is found to answer better than trellises in vineyards, because the vines after being properly pruned can be turned back and the ground cultivated more easily and cheaply. In summer the vines are spread out over the wide spaces between the rows. The vines are pruned on the “long” or extension principle (see “Long Pruning”), and the growths are disposed in summer

as shown in the illustration (Fig. 80, page 264). It is an admirable system of training vines on south borders, hot slopes, in orchard-houses, and in ground vineries.

Vines on Open Walls.—The walls generally must have south aspects, but the site (page 256), soil (page 249), and planting (page 259) have been fully treated; therefore, a few instructions for training and pruning only need be given here.

1. *Single Stem-upright Training.*—To cover a high wall the vines may be planted 3 feet apart, trained to single stems, bearing shoots or spurs being allowed to form on each side about 15 inches apart. The cane should be cut down to two buds. When the shoots

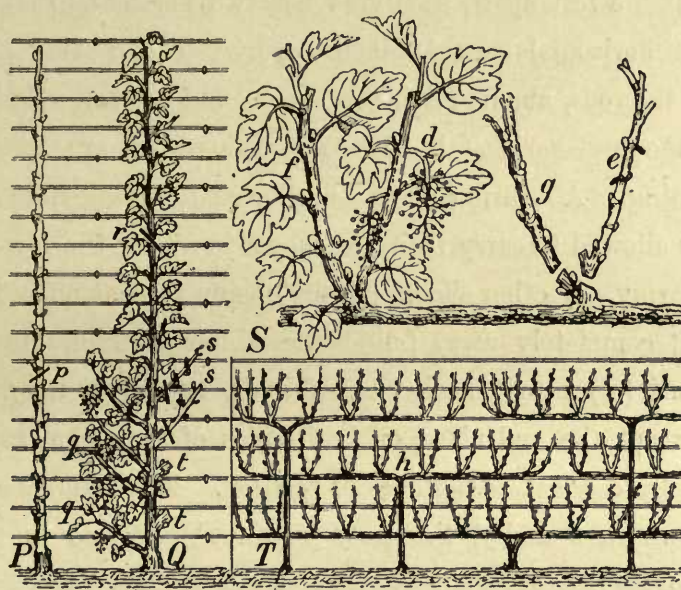


Fig. 81. SINGLE STEM-UPRIGHT, AND THOMERY SYSTEM OF TRAINING VINES.

References :—*P*, single stem-upright vine in autumn after planting; *p*, point of winter pruning. *Q*, single stem-upright vine in the second year, showing: *q*, bearing shoots pinched; *r*, point of shortening the cane at the winter pruning; *s*, leafless bearing shoots to be pruned to two buds—bars; *t*, bearing shoots after pruning, called spurs. *S*, bearing and pruning on the Thomery system: *d*, bearing shoot, cut away at the winter pruning (*e*); *f*, successional shoot, shortened to two buds (*g*). *T*, training on the Thomery system: *h*, horizontals extending equally on both sides of the stem.

push, select the strongest, rubbing off the other, train it upright, pinch the laterals at the first leaf and sub-laterals to one joint, but allow the cane to make all the extension possible. If the vine divide into two leads pinch off the weaker, and by autumn the thickness of the cane may equal that of the second finger or that of the thumb. Such thickness represents a cane strong enough for producing good side-shoots and fruit. If the young vine is smaller than the little finger cut the cane back to two buds, and let it grow another year, when it will have gained sufficient strength for bearing when shortened to 4 feet 6 inches, as represented in Fig. 81, *P*, *p*. The following year disbud so as to have the side-shoots 12 to 15

inches apart, pinch them one joint beyond the fruit, or at the sixth joint if there is no fruit; pinch laterals and sub-laterals to one joint as made (*Q*, *q*). Continue the stem by taking a cane from the extremity, and shorten it when the leaves fall in the autumn to about 4 feet (*r*), and spur the side-shoots (*s*) to two buds at the same time, as is indicated by the bars and the pruned shoots (*t*). The third season's training corresponds to the second, and so on. One shoot is left on each spur to produce fruit and the other rubbed off, or two may be retained as in the "Thomery" system.

2. *Modified Thomery Training*.—This admirable French system is shown in *S* and *T*. The vines are planted 3 feet apart, each vine has two horizontal rods on the same level, and the courses of horizontals are 18 inches apart. The bearing shoots proceed from the upper side of the rods, about 12 inches apart, and are trained upright and stopped when they reach the next horizontal. These upright shoots are cut back to two buds at the winter pruning. A bearing shoot is allowed to spring from each bud, but the upper one only is allowed to carry fruit, as shown in *S*, *d*; the lower one forms buds for next year's bearing, all other shoots (if any) being rubbed off. The shoot that has borne fruit is cut completely away (*e*) at the winter pruning, but the other, which has not borne fruit (*f*), is cut back to two buds, as shown in *g*. The horizontals extend equally, except the end vines, on both sides of the stem, as in *T*, *h*. By this method the shoots have equal advantages of position. The laterals are closely pinched in summer as shown in *d* and *f*, the wood matures well, and the fruit is borne on parts specially provided.

3. *Upright Training with Several Rods*.—This is practised where a large space has to be covered. The vine in that case is shortened to promising buds at 12 inches from the ground, and from those two shoots are trained upright at 2 feet apart, allowing them to make all the growth possible, with the laterals and sub-laterals closely pinched. In autumn the canes are brought down and trained horizontally to the right and left of the stem on the same level, at 12 to 18 inches from the ground. All the buds are removed excepting those situated on the upper side at 1 foot on each side of the stem, and at 2-foot intervals along the canes, each cane being left as long as the wood is well matured. Let the shoots from the buds left be trained perpendicularly, and in autumn cut each upright back to 3 or 4½ feet according to the strength, bringing the extremity shoots down to the horizontal line, removing the buds as already explained. From each upright rod reserve shoots at 18 inches apart on both sides, having them alternate, rubbing off the rest, and continue the upright by taking a shoot from its

extremity. In this manner proceed until the space is covered, the vines being pruned on the spur system, as shown in *Q*, page 265.

4. *Horizontal Training*.—A cane is trained upright and shortened in winter to 3 or 4½ feet according to its strength. Shoots are taken from the upright to the right and left at 18 inches apart to form the horizontal rods, whilst a leader is taken from the extremity in continuation of the stem, the horizontals being similarly extended, and so on until the space is covered. This is an admirable system of training vines against the walls of a dwelling-house or building, pruning them on the Thomery method, *S*, page 265.

5. *Informal Training*.—Vines against the walls of cottages and other buildings may be trained on no particular system, yet produce fruit abundantly, with the growths so disposed as to fully develop and mature. A vine is planted and shortened to a foot from the ground, and it pushes two or three vigorous canes, which are spread over the space, and in autumn shortened to 3, 4½, or 6 feet, according to their vigour and the ripeness of the wood. If the vine has three canes, the central one is cut back to about 18 inches, and the side canes are brought down to an angle of 45°, or lower, so as to spread well over the lower part of the wall. The following year shoots are left wherever there is room for a growth not less than 18 inches from the others. By this method the space is quickly covered with bearing shoots, some pruned on the spur and others on the extension system. This is the simplest, also one of the best methods of training vines on walls if it is properly carried out. The growths can be taken everywhere, to cover the space between windows, and when a rod ceases to produce fruit freely on spurs it can be cut out, and a sturdy fruitful cane taken in its place. Thus the vine may be kept well furnished with bearing wood by laying-in young shoots where there is ample room for them, and cutting away a portion of old wood that has been weakened by close pruning and continued bearing. The secret of success rests in the thin disposal of the summer growths.

Vines against walls must be carefully disbudded, not allowing three to five shoots to remain on a spur where there is only space for one or two; stop the bearing shoots one or two joints beyond the fruit, and repress all subsequent laterals. Allow one bunch to each shoot, and before the berries touch each other thin half of them out with sharp-pointed scissors. Avoid over-cropping and expose white varieties to the light when ripening. In a dry season supply water, soapsuds, or liquid manure once a week. Syringe the vines when the fruit is set, and in the evening of hot days until the grapes commence ripening. Secure the bearing shoots to the wall. Regulate

other growths and allow ample room in the ligatures for their swelling. The shoots should be thinly disposed so as to admit light and air. A thicket of leaves prevents the sun heating the wall. The walls are best wired in the ordinary way. Forked sticks secured to the trellis may be used to keep the bunches clear of the wall. Protection from late spring frosts is desirable, but heavy material excludes so much light as to be harmful. Glass projecting copings, with light open material suspended in front during the prevalence of frost, afford ample protection, and are useful in throwing off rain when the fruit is ripening. Hexagon netting may be employed when the fruit is ripe to protect it from wasps and bluebottle-flies, or the bunches can be placed in muslin bags. Prune the vines when the leaves fall. The black grapes mentioned for vineyards (page 263) are good for walls; Chasselas Vibert is the best white grape for the purpose, Royal Muscadine also succeeding on open walls.

CULTURE UNDER GLASS.

Ground Vineries.—To the late Dr. Samuel Newington, of Ticehurst, the horticultural world is indebted for this simple method of growing grapes. His method, however, differed from that which is now practised. It consisted of a ridge of glass placed over a trench lined with slates; over this trench the stem of the vine was suspended by cross-pieces of wood or iron, and the bunches of grapes were to hang in the trench. Owing to the danger of the water collecting in the trench, Mr. Thomas Rivers dispensed with it, and placed two rows of bricks endwise, leaving half a brick space between for ventilation, on a level piece of well-drained ground, and then paved the covered space with large slates placed crosswise. The vine lies along the centre, and is pegged down through the spaces between the slates. On these the bunches of grapes lie, and, owing to the heat of the surface on which they rest, they ripen early and well. An improved ground vinery is shown in Fig. 82, the south side of which opens, swinging on two bolts, one end screwed into the end bar, and the other let into the frame. A small handle is fixed on the bottom bar. Thus there is a perfect command over the vine inside. The vinery is $7\frac{1}{2}$ feet long, and, for a single vine in the centre, 36 inches wide at the base, and 20 inches deep in the centre; for two rods, 4 feet wide, and 2 feet deep in the centre. The ends are of wood, with an air-hole, provided with a door, to be closed when required. The ends should be movable, so that two lengths or more can be joined, and the vine or vines extended. These structures should be glazed with 21 ounces, thirds, sheet glass. One brick in height answers for the small-sized frame, but

the large vinery must be placed on a wall two bricks in height, leaving apertures half a brick wide, and 6 inches deep, for ventilation. The vineries should stand north-east and south-west.

The vine should not be planted under the glass, but at one end outside, as shown in Fig. 82, *U*. Where the soil is unsuitable, take it out 2 feet deep, and supply fresh compost on good drainage. Cut the vine down to 9 inches; let the growth from the uppermost bud only remain, stop it at a length of 4 feet, continue a growth from its extremity, and pinch it at 1 foot from the end of the vinery. Keep laterals and sub-laterals pinched to one leaf. Shorten the cane to 3 feet of the old wood in autumn, cutting the laterals close in. In the following year leave the side-shoots 12 to 15 inches apart on both sides of the rod, stop them at one joint beyond the fruit, or at the fifth or sixth leaf, pinch the laterals to one leaf, and allow three or four bunches only to remain.

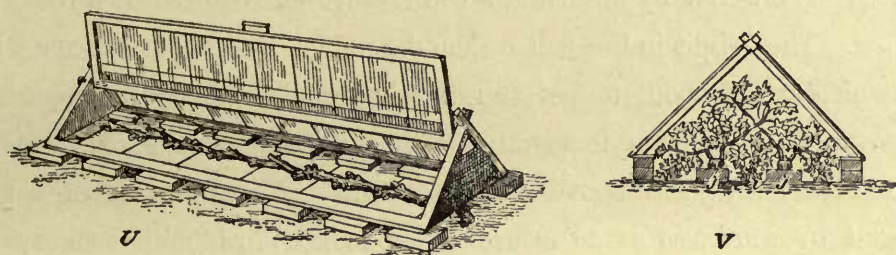


Fig. 82. GROUND VINERIES.

References.—*U*, vinery on one height of bricks per single rod. *V*, large vinery on two heights of bricks: *i*, slates or tiles; *j*, bricks on which to rest vine rods.

Take a leading shoot from the extremity, treating it similarly to its predecessor, both in summer and autumn, and at the winter pruning shorten the side-shoots to two buds. This procedure is followed in subsequent years, the leader being shortened to 3 feet, and the spurs to two buds annually. The vinery may be extended to any length by placing the desired number of frames end to end, or the vine can be confined to a single frame. The lights may be removed, after the fruit is cut, for about a fortnight, to ripen the wood, but not until the foliage commences to mature.

The situation for ground vineries must be open, dry, and sunny. The vines commence growing in April, and the young shoots are apt to be injured by frost, especially when in contact with the glass. We advise the vines to be trained to galvanised wires, about 1 foot from the surface of the tiles, which are preferable to slates. The ridges can be covered with mats in the evening, removing them in the morning after the frosts are gone. The bunches should be thinned, and over-cropping avoided. Birds may be kept out by

netting, and the ventilating apertures are best covered with galvanised-iron netting, small enough in the mesh to exclude mice. If mildew or red spider appear on the vines sprinkle flower of sulphur on the slates.

Vines in Unheated Houses.—There are many house and other walls which, if covered with glass, would grow useful grapes. A south aspect is the best, yet grapes ripen in unheated houses with east and west exposures in warm localities. The site should be high and dry. In such structures grapes can be grown better than against open walls, as the sun heat may be husbanded. We have seen excellent fruit produced by vines under a glazed verandah.

Span-roof houses answer in favourable localities. The sides need only be 18 inches in height, formed of two boards, the uppermost being hung at the top and opening outwards for bottom ventilation; a similar opening at the top of the house closed with a board, raised or lowered by mechanical contrivance as required, is a ready means of top ventilation. The height in the centre should be about 8 feet 6 inches for a house 12 feet wide, which gives about 9 feet of rafter on each side. If the house is wider all the better, as fluctuations of temperature are less sudden when a good body of air is enclosed. Let the ends, glazed above the level of the boarding, face north-east by north and south-west by south, so as to insure a good heat inside the vinery with the forenoon, and maintain it until late in the evening by the afternoon sun.

The vines can be planted in borders at the sides of the house at 3 to 5 feet apart, and trained to a roof trellis. They may be planted outside, and will require little or no attention for water in ordinary seasons. With the boarding portable, the vines can be taken outside in the winter, and the house utilised for other purposes, reintroducing the vine rods in March.

As the heat is such as the sun furnishes it must be husbanded from spring to autumn. Activity in the vines does not commence before the vernal equinox and the grapes are ripe before the autumnal equinox. From the fall of the leaf until the buds swell ventilate fully in mild weather, and when the external temperature is above freezing, or when the sun acts powerfully upon the house so as to raise the inside temperature to 50°, admit air freely. In cold, frosty weather the structure may remain closed. When the buds are swelling ventilate slightly at 50°, fully at 55°, and close at that temperature. Strive to retard rather than accelerate growth early in the season. When the first leaves appear admit air at 55°, keep through the day at 65°, and close at the latter heat. When the leaves are fully expanded ventilate slightly at 60°, freely at

65°, and close at 75°. With the foliage fully out commence ventilating at 65°, and increase it with the increasing heat. In dull weather only a little ventilation is needed to insure a change of atmosphere. In bright weather the heat will rise much higher than the degrees mentioned, and will do good with full ventilation by securing sturdy wood and well-developed foliage. When the vines are in flower, admit a little air constantly, and with the grapes set and swelling, open the ventilators a little at 70°, increasing the air at 75°, having the ventilation full when the temperature is between 80° and 85°, and maintain that temperature whenever opportunity offers. Close before the heat has declined below 80°, and if it rise to 85°, 90°, or 95°, with a declining sun, it will benefit the grapes, which swell best in a moist, warm atmosphere. A little air admitted at the top of the house before nightfall allows the pent-up vitiated air to be changed, and it is a good safeguard against scorching in the morning. Thermometers for indicating the temperatures must be shaded from the sun. When the grapes are ripening, open the top and bottom ventilators about equally, so as to insure a circulation of dry, warm air, and do not close so early as previously. This causes the night temperature to be lower, and rests the vines, thus enabling them the better to mature the crop and wood. When the grapes are ripe admit air more freely, both day and night, except in dull foggy weather.

The great evil to contend against with ripe grapes in cool houses is damp. If the air becomes still and cold, moisture condenses on the berries, decay speedily following. There is no better preventive than to cut a small hole in the middle of a circular piece of cardboard, large enough to cover the bunch of grapes, with a slit from one side of the disc to admit the stem of the bunch. These covers shield the berries from the descending moisture, and with a little air constantly, increased early on fine mornings, the grapes keep sound for some time. But it is a safer plan to cut the grapes after they become ripe with sufficient wood for insertion in bottles of water with a few pieces of charcoal. The leaves, if not off, should be removed. The bottles should be fixed in an inclined position so that the bunches hang clear in a dry room, from which frost is excluded. The grapes may then keep sound until Christmas, if berries with the least signs of decay are promptly removed.

With free ventilation day and night after the grapes are cut the foliage and wood become mature. Prune the vines shortly after the leaves fall. Keep the border moderately moist during the winter if the roots are inside, supply water in March so as to bring the soil into a thoroughly moist state, and never allow the vines to lack mois-

ture and nourishment at the roots during their growth. Vines in cool houses require less moisture than those in heated structures. Damping the borders and all other surfaces in the morning and at closing time suffices from the time of the buds swelling to the grapes ripening. When the vines are flowering and after the grapes are somewhat advanced in ripening, also in dull weather at any time, syringing is not necessary, and in early summer it is desirable to have the atmosphere dry when there is a prospect of frost at night. Such are the chief points requiring attention in growing grapes in cool houses; in other respects their treatment corresponds to that of vines in heated structures.

Vines in Greenhouses.—The structures designated greenhouses are almost as variable as the positions they occupy, the term, “greenhouse,” having a wide application. It is usually understood to indicate a structure specially devoted to the cultivation of plants that never require a high temperature, yet must be safe from frost. The interior is furnished with stages for plants in pots, and not unfrequently climbers are trained up pillars and to trellises beneath the roof. Such a house is no place for vines unless the climbers are discarded, and they might very well be dispensed with in many cases through their being so liable to the attacks of insects. Vines will not flourish where they cannot have abundance of sun, and they can hardly be expected to grow and bear well where they cannot have a proper medium for the roots. A large border is not necessary, and in many places the natural soil is as good for vines as any that can be prepared. The great point is good drainage. Calcareous or siliceous soil answers when loosened and enriched to a depth of 2 feet. The vines should be trained to the wires under the rafters, and the bearing shoots, about 18 inches apart on both sides of the rods, can be trained to wires 9 inches from the centre wire and 15 inches from the glass. By this arrangement and the vines not nearer each other than 4 feet 6 inches, the plants beneath receive a considerable amount of light, whilst the vines enjoy abundance, and the grapes often equal those grown in proper vineries.

A moist, confined atmosphere should always be avoided in a greenhouse; cold draughts and improper ventilating are equally to be condemned. When the current is cold and strong, air may be admitted on the opposite side to that from which the wind blows. During warm weather too much air can scarcely be given, and a little ventilation at the apex, especially when the house is closely glazed, is advisable whenever the weather is mild. These remarks apply to greenhouse plants as well as to vines, and both will answer in the same temperature. In winter vines will rest in a temperature

ranging from 40° to 45° by artificial means, and that is ample for greenhouse plants. The vines should start in April. From autumn to early summer the house may be kept gay with flowers, commencing with chrysanthemums, these followed by bulbs of various kinds, also primulas, cyclamens, cinerarias, camellias, azaleas, and several others, to be removed when their beauty is over. In summer such plants as ferns, palms, and coloured-leaved plants, including begonias, will succeed under the vines and render the house agreeable. The vines go to rest in the autumn, and any grapes then hanging may be cut, bottled, and placed in a dry room. Prune when the leaves fall, thoroughly cleanse the house, and it will be ready for the winter and spring plants. This utilisation of plant-houses for grape growing is very old. Vineries and other fruit-houses are commonly used for such plants as can be grown without prejudice. Plant growing, however, in such cases is made subordinate to the vines or other fruits. The chief drawback to the system consists in the greater liability to insect infestations; therefore, strict attention to cleanliness is imperative.

When it is desired to use the house in winter for plants requiring an intermediate or stove temperature, the front or side lights will need to be so arranged that the vine rods can be taken outside in autumn, securing them to stakes along the border, and protecting them with a little dry hay or soft straw in severe weather. The vines (planted outside) are introduced to the house in spring, early or late, according to the time the grapes are required, but it ought not to be deferred beyond the swelling of the buds. This was a common practice when pineapple culture was a feature in most garden establishments, yet useful grapes were grown, and so they may be in conjunction with plants under good management, which includes scrupulous attention to cleanliness. If insects are permitted to infest either vines or plants, neither can flourish and give satisfaction.

VINERIES.

Three forms of houses are employed in the production of grapes—1, lean-to, *i.e.* leaning against a wall; 2, three-quarters span-roof—a lean-to and half backed; 3, span-roof—two lean-to's joined back to back without the wall.

1. *Lean-to Vinery*.—This is the oldest form, and, where a wall exists against which to erect it, the most economical. The roof should face the south for receiving the most sun, and the back wall will afford shelter from the north. In Fig. 83, A, is shown a lean-to house, with the roof at an angle (calculated from the base line) of about 25° , which, in a locality not subject to a heavy rainfall, and constructed in the best manner, is

found most suitable for midseason and late vineries, through the temperature not being so liable to sudden fluctuations as in structures with more acute roofs. This is important in preventing the leaves and grapes scorching in the summer, while an equable temperature is favourable to the keeping of grapes in good condition in the autumn. Where the climate is moist and the rainfall over 30 inches per annum, the angle may be 30° , which is ample for mid-season and late houses generally; 35° to 40° answers

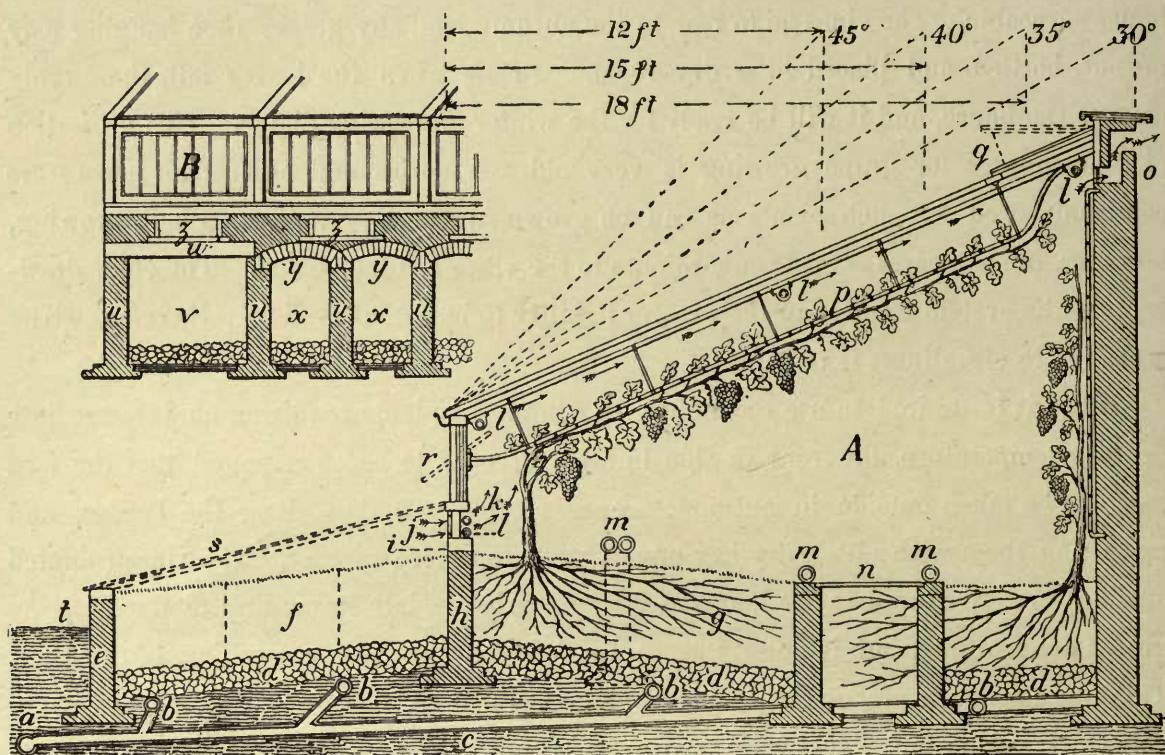


Fig. 83. LEAN-TO VINERY. (Scale: $\frac{1}{4}$ inch = 1 foot.)

References :—A, lean-to vinery : a, land drain ; b, border drains, lengthwise ; c, outlet main border drain ; d, rubble drainage, 1 foot deep ; e, retaining wall ; f, outside border—dotted lines show portions of border to be made at one time ; g, inside border ; h, front wall, 9-inch pillars ; i, stone head ; j, ventilators in front wall ; k, arrows showing ingress of air ; l, $1\frac{1}{2}$ -inch galvanised wrought-iron hot-water pipes ; m, 4-inch hot-water pipes ; n, pathway, iron grating ; o, back-wall ventilators ; p, trellis, 2 feet from the glass ; q, top lights ; r, front lights ; s, temporary lights to place on outside border ; t, ground level. B, part elevation of front wall : u, 9-inch pillars ; v, large opening covered with stone head, w ; x, small openings with skew-back arches, y ; z, wall ventilators.

well for houses to ripen grapes in late May or early June ; and the earliest houses need not have a steeper roof than 45° . These angles and desirable widths of the structures are indicated in the outlines and figures above the vinery (Fig. 83, A), in which due provision is made for efficient heating and ventilation.

The front-wall ventilators (j) should be hung on pivots, and opened and shut by mechanical contrivance. Similar remarks apply to the back-wall ventilators (o), fixing

these on the inside, and placing perforated zinc over the outside of the openings. By means of the ventilators and the $1\frac{1}{2}$ -inch roof pipes, the house can be ventilated in any weather, and moisture expelled or frost excluded. These roof pipes prevent moisture condensing on the glass, and are otherwise advantageous to the vines. The trellis should be of galvanised wires, placed longitudinally of the house, 9 inches apart, supported by iron bars ($\frac{3}{4}$ by $\frac{1}{4}$ inch), pierced with holes at the proper distance apart, through which the wires are passed, and the bars held by iron hooks, as shown. The wires are threaded and strained with thumbscrews at the ends. Long eyes are sometimes used to guide and support the wires, but they are not so serviceable as iron bar guides, one to each rafter, and angle iron at the ends for straining. Galvanised iron sometimes acts injuriously

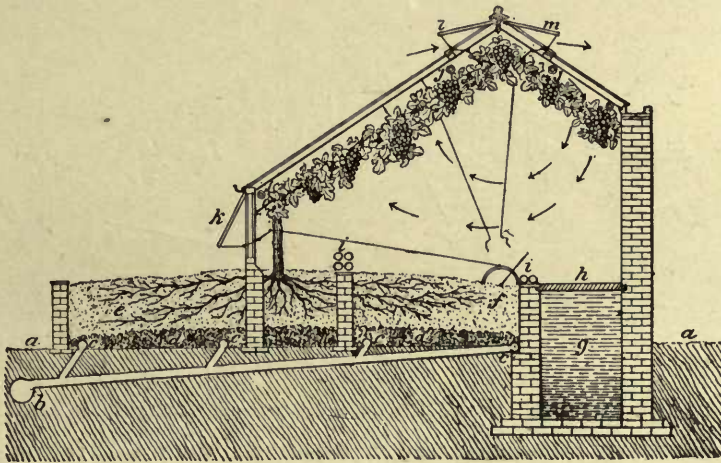


Fig. 84. THREE-QUARTERS SPAN-ROOF VINERY. (Section through C2, D2, Ground Plan, Vol. I, page 71.)
(Scale: $\frac{1}{8}$ inch = 1 foot.)

References:—*a*, ground level; *b*, outlet land drain; *c*, longitudinal border drains; *d*, rubble; *e*, outside border; *g*, rain-water tank; *h*, path; *i*, 4-inch hot-water pipes; *j*, $1\frac{1}{2}$ -inch hot-water pipes; *k*, side lights; *l*, south top lights; *m*, north top lights. The angle of the roof is 35° .

on growths tied to it, but the defect is overcome by painting. The trellis should not be less than 16 inches from the glass, and it need not exceed 2 feet.

2. *Three-quarters Span-roof Vinery*.—This shape is approved (as well as a lean-to) for early forcing, Muscat, and late grapes. It has a comparatively low back wall, provides plenty of light, and effective ventilation when the roof has both south and north top lights for opening, as shown in Fig. 84.

In frosty weather the back lights (*m*) often become icebound, unless hot-water pipes are provided under the roof. They are desirable on both sides (*j*), so that the north lights can be opened when the wind blows cold and strong from points between east round by the south to the west, and the south top lights when the wind is fierce from the north.

In general, air is best admitted by both, as the wind enters by one side, and passes through and out at the other, as shown by the arrows, and sucks out the vitiated atmosphere, without causing a chill by a down draught, such as occurs when one (*m*) is closed, and the other (*l*) open, as indicated by the arrows inside the house. The $1\frac{1}{2}$ -inch hot-water pipes keep the roof lights free in severe weather, take off the chill of cold air, and snow cannot lie on the glass. The three-quarters span-roofed house should face due south.

3. *Span-roofed Vinery*.—This style is fashionable and generally useful. It affords abundance of light and a large amount of roof space. It is a good form for mid-season and late grapes. The best results are considered to be obtained by placing the ends due north and south, but when convenient we find it better to dispose the house the same

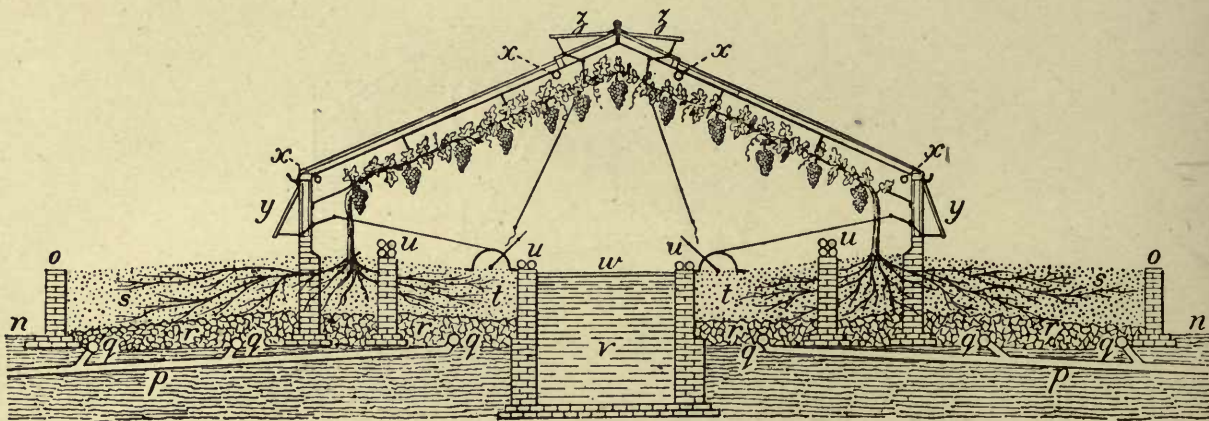


Fig. 85. SPAN-ROOFED VINERY. (Section through *Jl, K1*, Ground Plan, Vol. I., page 71.) (Scale: $\frac{1}{8}$ inch = 1 foot.)

References :—*n*, ground level ; *o*, retaining wall ; *p*, outlet drains ; *q*, drains lengthwise of borders ; *r*, rubble drainage ; *s*, outside borders ; *t*, inside borders ; *u*, 4-inch hot-water pipes ; *v*, rain-water tank ; *w*, walk ; *x*, $1\frac{1}{2}$ -inch hot-water pipes ; *y*, side lights ; *z*, top lights.

as ground vineries (page 269). Neither position can be had in many places owing to the site sloping to the midday sun, and there is no objection whatever to the ends being east and west, growing the white grapes on the south side, the black on the north, and providing hot-water pipes under the roof, as shown in the illustration at (*x*).

When the weather is cold, wet, or severe, the hot-water pipes in the roof prevent the exposed surface cooling rapidly and secure a regular temperature within the span-house ; a little ventilation expels damp, and ice does not form on the inner surface of the glass in severe weather, as occurs when roof heating is not employed, the grapes then being spoiled by the water falling on them as the ice thaws.

TRAINING.

The "cut-back" vine (Fig. 78, *G*, pruned as marked at *x*, page 261) to two buds produces two shoots ; the weaker is rubbed off, the other retained. Place a small stake

to each vine to conduct it to the trellis, and a stake across the roof wires to fasten the



Fig. 86. TRAINING YOUNG VINE FROM "CUT-BACK" FOR FRUITING IN POT, AS A "SUPERNUMERARY" AND AS A PERMANENT VINE.

References :—A, vine in first growth from "cut-back" : *a*, disbudded shoot ; *b*, laterals and sub-laterals stopped at one leaf ; *c*, point of removing laterals in autumn or when the foliage is ripening ; *d*, point of heading cane in autumn ; *e*, extension of growth and laterals from leader ; *f*, sub-laterals extended. B, pruned cane. C, second year's growths—detached shoots show disbudding up to the trellis ; *g*, *h*, and *i*, laterals if allowed to grow for fruiting ; *h*, side or bearing shoots ; *i*, leader or main stem—all the detached growths are not wanted on young permanent vines ; *j*, laterals pinched to one leaf ; *k*, tendrils.

young cane to as it progresses. When the vines are 9 feet long take out the point of

each, and stop all laterals and sub-laterals to one leaf as produced. If the growth is very vigorous, the upper buds on the cane may start; if they do, allow the sub-laterals from that part to extend to two or three leaves before stopping them. This will utilise the surplus sap, and the lower buds will become plump and have two or three embryo bunches of grapes in them by the end of the season. Such treatment will result in at least eight bunches of fine grapes the following season. It is the practice resorted to in preparing vines for fruiting in pots, or as "supernumeraries" for early bearing, and is shown in the illustration (Fig. 86, *A*, without the detached growths *e, f*).

The growing canes of vines for fruiting in pots, also as supernumeraries planted out, are stopped at 9 or 10 feet, or, in other words, when they reach that height the points are pinched out, and the side growths or laterals are pinched to one leaf as often as such leaf forms (see example); but in the case of vines intended to be permanently established it is considered desirable to allow the sub-laterals (*A f*) to extend (not disbudding up to the trellis as in *C*), also the extremity (*e*), and permit its laterals to spread. This is done with the object of thickening the main stem and stimulating root action. The practice is commendable where the vines do not exhibit a tendency to become gross and the growths are kept clear of the main leaves on the 9-foot length of cane, which must be exposed to the full influence of light and air. The spray should be curtailed in September, gradually reducing it so that none remains by the time the large basal leaves of the laterals assume their ripening tints. After this takes place the laterals are cut off close to the main stem, and the cane is shortened so as to have two side buds, and one for pushing a leader above the bottom wire of the trellis, as shown above the dotted line in *B*.

In the second year some gardeners rub off, as previously indicated, all the shoots up the main stem to the trellis, as represented in *C*, but others allow them to grow, pinching them at two or three leaves. Bearing shoots are reserved on each side of the rod above, not opposite, but alternate, for securing to the wires. These (*h*) may show two or more bunches, but one only should be retained on each, pinching off the rest, and taking out the point of the shoot when the leaf at the second joint above the bunch is the size of a halfpenny, serving sub-laterals the same, as represented. The tendrils (*k*) should be cut off close to the stem of the bunch. The leading shoot (*i*) is trained up the house and treated precisely the same as described for the cane *A*. It will show one, two, or more fine bunches, but cut them off, as shown detached. Two bunches are sufficient to leave on a vine the second year. The cane, if not stronger than the third finger, should be

shortened to 3 feet when the leaves have fallen; if as thick as the thumb, leave $4\frac{1}{2}$ to 6 feet of new extension wood. Prune a weakly cane to about 18 inches; one not thicker than the first joint of the little finger, shorten to three buds to force stronger growth.

The third year's training is merely a repetition of the second, that is, a shoot is taken from the extremity in continuation of the rod, bearing shoots are reserved on the sides of last season's cane at 15 to 18 inches apart, and four to six bunches of grapes allowed on a vine. Discretion must be exercised in the cropping of young vines, for they often

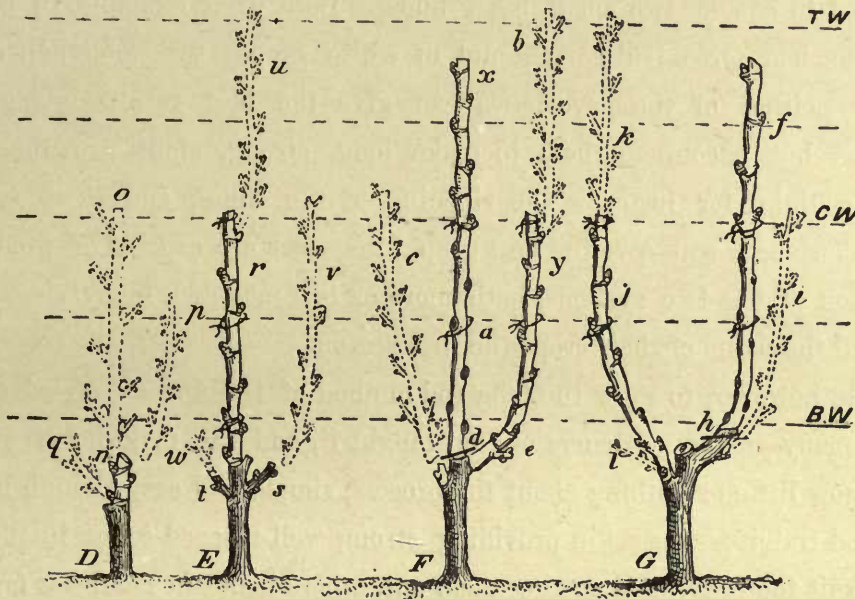


Fig. 87. LONG ROD TRAINING.

References :—*D*, a young vine that grew to the top of the roof or trellis and was cut back in winter—resulting growths foreshadowed : *o*, leader, topped in summer ; *p*, topped when two-thirds of the length ; *q*, topped at four or five joints. *E*, the cane *o* (now *r*) shortened a little in winter, for bearing, and producing an extension growth, *u* ; also side growths *v* and *w*, through pruning at *s* and *t*. *F*, extension cane *x* (*u* in *E*) shortened for bearing at the upper part of the roof ; *y* (*v* in *E*) for bearing at the lower part of the trellis ; *a*, bearing parts removed to give room for *c* ; the whole rod is taken out at *d* after the crop from *x* has been cut ; *b* taking the place of *x* the following year, and *c* that of *y*, with the bearing parts removed as at *a*, but a spur and good bud is left at *e* for a successional growth. *G*, vine fully established : *f* and *j*, bearing parts ; *i*, *k*, and *l*, successional ; *h*, removal of the rod after the crop from *f* is cut. *B. W.*, bottom wire ; *C. W.*, central wire ; *T. W.*, top wire.

produce large clusters, and one bunch may prove a heavier crop than three small ones. Overburdening vines in their early years impairs their constitution and they are not lasting. The training of the vines is the same year by year until they have extended to the limits; then they are pruned on the spur system, which was introduced about seventy-five years ago, and for general purposes is the best. It conserves the strength of the vine, and its simplicity, regularity, and neatness are great recommendations.

Long Rod Training.—Though this system was once commonly practised it has been

generally superseded by the modern method of relying on vines with rods many years old for producing fruit on side growths from them (laterals), and cutting these laterals closely back in winter so that spurs are formed along the main rods; yet the long rod system has its advantages. So long as satisfactory crops of grapes are produced by the close-spurring method no change is needed; but in the course of time the growths from very old rods become too weak for affording (when closely spurred) fine clusters of fruit, and the more robust the vines are in character the less likely they are to produce fruit when pruned to one or two small basal buds. Take, as an example, in black grapes the large-bunched Gros Guillaume, and in white grapes the noble-berried Duke of Buccleuch; neither of these varieties can give the best results under continuous "spurring;" but encourage them to make long, strong, stout growths, under full exposure to light for insuring the ripening of the canes, and these canes, if not materially shortened, will give the best grapes the vines are capable of producing. By a combination of the two systems, both more or less modified, many vines have more than doubled the value of their crops the first season.

We wish, however, to show the long rod method of training as carried out systematically, for many young gardeners are not taught it, and the majority of vine-growing amateurs know little or nothing about the process, simple and easy though it be.

Long rod training consists in providing strong well-ripened canes in one season for producing fruit the next, then cutting them out, others being in readiness for continuing the supply, and so on from year to year. All the fruit is produced by canes a year old only, exactly as in the case of vines fruited in pots, and the summer pinching of axillary growths is the same in both. Canes for bearing and growths for succeeding them are shown in the sketches. It will be seen that when the vines are fully established each has two canes, one reaching to the top of the house and bearing under the upper half of the roof, the other bearing from the base of the rafter halfway up the roof. The lower part of the long rod bore in the preceding year, and the bearing parts were cut out in winter. The removal of these gives room for a successional cane growth in summer. All this is shown in *G*, Fig. 87, and the preceding examples in the same figure show the process.

It will be apparent from the foregoing that the rafters are furnished with one rod for bearing fruit halfway up, and another rod for bearing from the centre of the roof to the top the same year, leaving a spur at the bottom of each to produce canes to replace the whole eventually. This system is much more easy to carry out than to

describe, and there ought to be no difficulty now in comprehending it. The chief danger lies in overcrowding the growths and overcropping.

The bearing shoots should be 18 inches apart on both sides of the rod (disbudding the others), but every shoot ought not to be allowed to bear, because from strong canes the bunches produced are invariably large, and overcropping must be strictly avoided. The rods should be 2 feet 6 inches apart, the vines being planted 5 feet asunder. With a generous rooting medium and good management abundant crops of grapes are produced by the system in question.

Extension Training.—This is the oldest plan of all, and most consonant with the natural habit of the vine. A vine is allowed to extend its rods or branches till it fills a large house. The vine has many rods instead of one. When the allotted space is occupied the extension ceases, and the vine, if then pruned on the spur system, produces smaller bunches than when it was extending. To maintain the greatest amount of vigour, a supply of young canes must be provided to take the place of rods which have the spurs elongated and weakened by continuous bearing. This is the principle of the extension system, and may be carried out in a vine with one rod as well as in one with many branches. But vines planted at 4 feet apart and confined to one rod each cannot possibly attain to such vigour and retain it so long as those planted 12 feet apart and brought away with three rods. The closer vines are planted or the rods trained the sooner they become exhausted, because the annual growths are not adequate for maintaining them in youthful vigour through the want of space, and the crops are disproportionate to the foliage. Vines with one rod are less easily replenished with young rods than those that have three or more rods when the old become worn out. But a cane can be trained up from the base of a rod that is weak in its spurs, and that cane treated the same as the old rod was in occupying its space, cutting away the spurs on the old rod to give the young cane space as it advances year by year, and when it is capable of bearing fruit the whole length of the rafter, the old rod can be cut out. By that practice a vine may be kept in a healthy state indefinitely, if the roots find appropriate food, and the growths are thinly disposed and kept clean.

The extension system in vines with many rods is a combination of the spur and long rod systems, and is practised on every part of the vine. Worn-out, enfeebled rods, and young canes that are heavy or weakened by crops, are shortened or cut clean out in favour of promising canes that have been provided to supplant them. Thus the

vines have fresh life and vigour imparted to them by the renewal of the parts for bearing. The growths are not stopped to any particular number of joints beyond the fruit, but they are allowed to extend as the space admits without unduly encroaching on other shoots, and no growths are tolerated except those that can have full exposure to light.

PRUNING.

The object of pruning the vine is to concentrate its energies on growths for the production of fruit. A newly-planted vine is cut back to two or three of its lowest buds, and only one shoot is retained, in order that the sap, which would have been distributed over an indefinite number of weak growths on an unshortened stem, may produce a vigorous cane. In pruning for fruit many of the fruit-producing parts are cut off to concentrate the vigour on the buds left. These must be well developed. Basal buds are generally the best matured, but they may be too weak to produce fruit, and it is useless relying on faulty buds, or buds on unmaturing wood, to afford shapely bunches of grapes. Bold, round buds on well-ripened wood will invariably afford the best fruit.

Spur Pruning.—This method is applicable to vines with one or many rods. A vine in its first and second years of spur pruning is shown in the illustration, Fig. 88. In *H* is shown a vine that was shortened to the lowest wire of the trellis and treated as described under "Training." It has two side-shoots, *n* and *o*, and it is the shortening of these to one or two buds that gives rise to the term spur. On the manner of doing this depends a good or bad spur. The bud next the stem may produce a vigorous shoot and a good bunch of grapes, but it is not always the case, for some vines have the basal bud so small and ill nourished as to show fruit very indifferently on the shoot produced from it. Free-fruited varieties in the best condition may be closely pruned so long as the vines continue satisfactorily productive. The first spur with one bud is shown in *H*, *o*, and the second year's spur is represented in *I*, *u*. The result is a compact spur, which only increases a joint each subsequent season. This rigid pruning keeps the spurs close to the rod, but the "hard-and-fast" line of adherence to it often shows neatness but no grapes. The uninitiated are apt to make the mistake of pruning vines too closely when they are unfruitful, for it is the amount of energy expended by the leaves on the buds that renders them fruitful, and not the mere concentration of sap on basal buds, which, from the smallness of the attendant leaves, may not form grapes in embryo. When the growths are weak one-bud spurring too often means sterility, and vines that have very small basal leaves and incon-

spicuous buds should not be pruned on the one-bud system, but on that which gives a choice in disbudding and a good crop of grapes.

Some vines show fruit freely for a time by close spurring, whilst others are the most

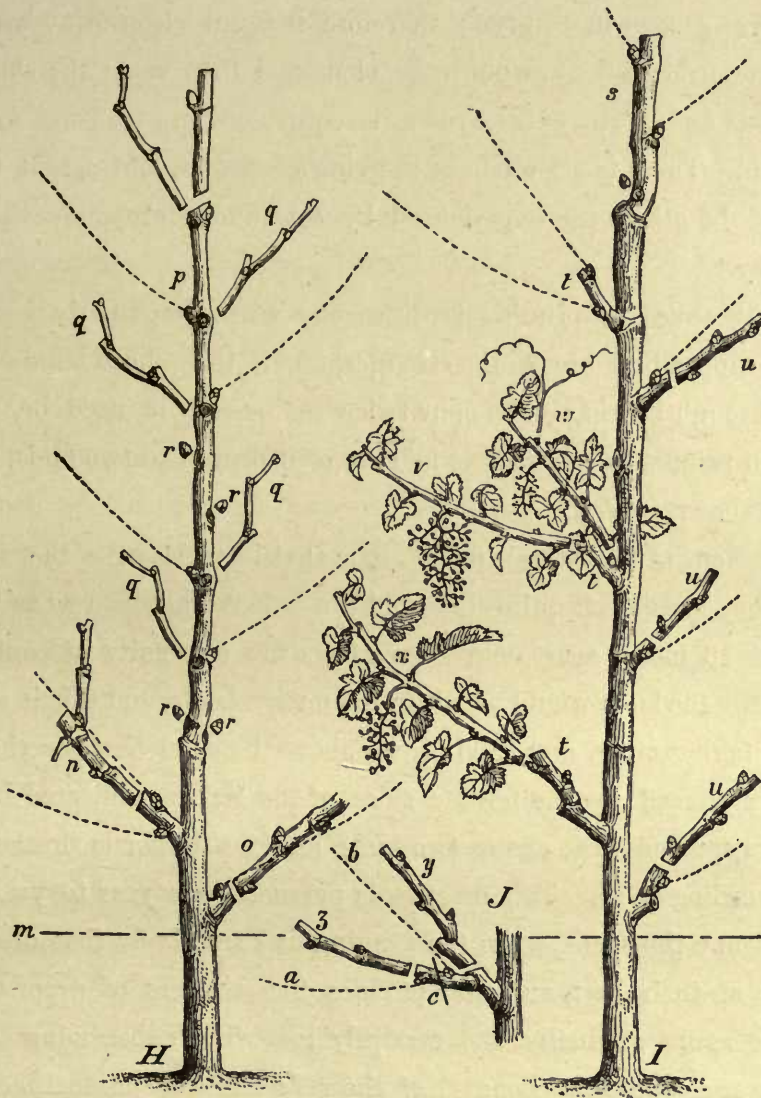


Fig. 88. SPUR-PRUNED VINES.

References :—*H*, vine in the first year of spur pruning : *m*, lowest wire of trellis ; *n*, bearing shoot spurred to two buds ; *o*, bearing shoot spurred to one bud ; *p*, cane shortened so as to originate four bearing shoots (outlined) and a leader ; *q*, laterals cut off close to the cane ; *r*, buds taken out. *I*, vine in the second year of spur pruning : *s*, leader cane ; *t*, bearing shoots pruned to two buds ; *u*, bearing shoots pruned to one bud ; dotted lines indicate the direction of shoots from the buds left ; *v*, good system of bearing when pruned to two buds ; *w*, shoot not allowed to bear fruit ; *x*, bad plan of bearing in pruning to two buds. *J*, spur pruning with two buds : *y*, bearing shoot cut away after fruiting ; *z*, unfruited shoot shortened to two buds—dotted lines indicate third year's growths : *a*, shoot allowed to bear, and cut away afterwards to *c* ; *b*, shoot uncropped and shortened to two buds.

profitable on the alternating principle, or spurring to two buds, as shown in *H*, *n*. The upper bud breaks the stronger and produces the fruit as in *I*, *v* ; the other shoot, as *I*, *w*,

is stopped at the fifth or sixth leaf, has all fruit or tendrils cut off, and the laterals pinched to one leaf, so that it forms good basal buds for bearing the following year. The shoot bearing fruit has its energies so taken up that its basal buds are too ill nourished to form grapes in embryo; therefore it is cut clean away after fruiting, as shown in *J, y*, and the spurs are not more elongated than when the shoots are closely spurred in to one bud. The extra growth is equivalent to extension, keeping the vine in robust health. There is no waste of the vine's energies, but actual recuperation of loss that would be otherwise experienced by continuous cropping through channels impaired thereby.

Leaving long spurs in pruning is disastrous when improperly carried out, as it is in *I, t*. The upper bud breaks the stronger, and if that shoot *x* only is left, there is enfeeblement through bearing and a spur twice as long as it need be, or would have been had it been pruned to one bud, as in *I, u*, or if pruned to two buds, as in *H, n*, and then treated as shown in *J, y*.

The management of the laterals on the cane that is to become the rod is shown in *H, q*, that is, they are cut off quite close, and the cane is shortened so as to originate four side growths at 18 inches apart, and a cane from the extremity in continuation of the rod. To leave all the buds would result in too many shoots, and this is avoided by thinning the buds, taking out *r*, and leaving two above them, so that the shoots to form the spurs will be produced upon alternate sides of the rod, as indicated by the outlines. Such shoots are spurred in to one or two buds, and the leader is shortened similarly to that of the preceding year. This practice is pursued from year to year until a rod is provided to occupy the space, when the pruning is exclusively that of the spur. The vines then are at their best, and may produce fine clusters of grapes during several years; but the spurs gradually and certainly lose vigour, becoming so thickened and elongated as to necessitate the removal of the rods and the production of others with the essential spurs so as to maintain the vines in profitable bearing. The renewal of the rods is shown in Fig. 89.

Long Pruning.--The long rod system in its integrity consisted in having an annual supply of young canes from the bottom to the top of the house or wall. These, after producing fruit, were cut away, and replaced by other shoots from the base. The long rods only pushed strong growths at the upper part, those from the lower part being much weaker. To remedy this defect the annual canes were shortened to about half the length (page 279) they would have been left by long pruning. Long pruning

is not much practised now, being generally superseded by the spur system, by which medium-sized, compact bunches with perfect berries are obtained. It is the best method for the free-bearing varieties. The rod system, however, is more favourable to the strong-growing varieties, and if very large bunches are wanted this is the way to secure them.

Combination Pruning.—Having regard to the prolonged vigour of the vine, there is no system equal to this, which combines every advantage of the rod with the spur methods. Its principle consists in pruning to the best bud, thus making sure of a crop of fruit, and at the same time preventing the vine lapsing into an indifferent condition. With care no unnecessary wood is produced, nor crowded foliage, and if no more growths are allowed to be made than will permit of a proper leaf development, fine bunches will be produced on the young rods and useful grapes from the spurs. The lines upon which the pruning is conducted may be gleaned from the accompanying engraving, Fig. 89.

The combination system comprises every good feature of training and pruning vines. The cane *L*, *e* (long pruning) has the full bearing power of a pot vine or supernumerary (Fig. 86, *C*, page 277). The rod *j*, *k* has all the characters of a spurred vine with extension growth, while *g* and *h* represent short rod pruning for bearing and continuation. Weak parts are cut out and strong provided; thus the vines undergo constant rejuvenation and, under good management, bear crops of excellent grapes over a long series of years.

Early Pruning.—This is essential for the vine. It should be done as soon as the leaves fall. This insures complete rest, and any movement of the sap during the period of repose will be concentrated on the buds left, enhancing their vigour. After late or spring pruning the vine bleeds, that is, the sap exudes copiously from the

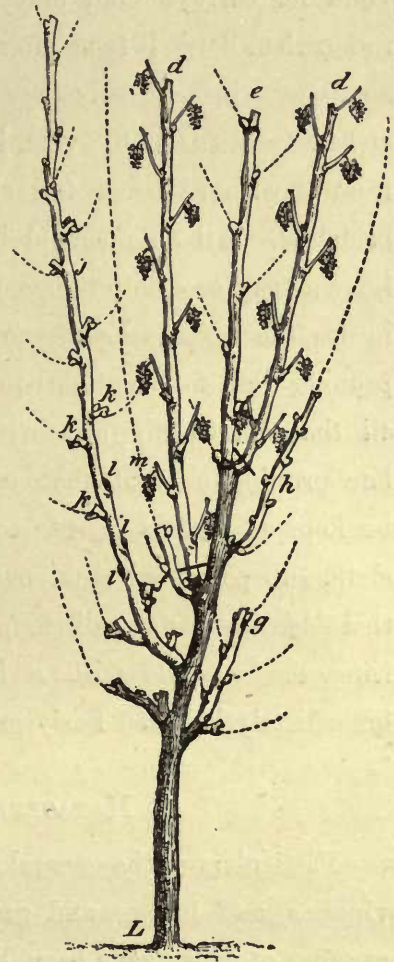


Fig. 89. VINE PRUNING ON THE COMBINATION SYSTEM.

*References :—**L*, part of vine showing long pruning system : *d*, rods cut away to the bars after fruiting ; *e*, cane long-pruned ; *f*, cane from base, pruned to three buds to supply successional cane to *d*. Short rod system : *g*, cane shortened to plump buds for bearing ; *h*, cane for bearing and continuation ; *j*, rod spur-pruned ; *k*, spurs on three-year wood ; *l*, spurs cut away to give room for the bearing parts of the cane *m*.

wounds, and the effect of losing a large quantity of this fluid just at the time it is most required is to retard growth and induce debility. We say, therefore, prune early; vines for early forcing may be pruned a few days in advance of the leaves falling rather than delay it long afterwards; all should be pruned as soon as they are at rest, and later vines directly they are cleared of the fruit. In cases of cutting out old rods or large portions of the vine, it is the safest to act whilst the foliage is intact—any time from the leaves being full sized to their fall, and the parts which are left will be benefited. All cuts should be made slightly in advance of the buds, not so as to leave a snag or stump to be cut off afterwards, but close enough to the bud or branch to insure the wounds healing over quickly. Any stumps should be cut clean off at pruning time, for they harbour insects, and are unsightly. It is a good plan to dress all the wounds carefully with shell-lac solution or best French polish, especially in late pruning, as a safeguard against bleeding. When bleeding occurs, the house should be kept as cool as is safe to check the flow of the sap, then dry the wounds with a cloth, rub powdered alum over them, and dress with the French polish. Remember that bleeding is not a disease, but a result of amputation at the wrong time, and cauterising the wounds with a hot iron is a barbarous practice, often killing the buds immediately below. Early pruning is the best preventive of bleeding.

MANAGEMENT OF VINES IN HEATED STRUCTURES.

Particulars of the general management of vines in vineyards, against walls, in ground vineries, cool houses, and greenhouses have received attention, and the training and pruning of vines have been liberally treated. Instructions for the general treatment of vines in heated structures from the time of starting until cleared of their crops must now have consideration. Some of the subjects to be treated are applicable to vines generally; therefore, matters which have not been referred to in any of the foregoing branches of vine culture will be found under their respective headings in the following pages.

Manures and Manuring.—Poor or light soils require early, frequent, and liberal dressings of organic manures, that is, substances of a nitrogenous nature, and which supply humus. Such are found in stable or farmyard manure, turf and other vegetable or animal matter. Blood, soot, horn shavings, sulphate of ammonia, guano, and nitrates of potash and soda are nitrogenous manures of the first order. No vine can flourish without a supply of nitrogen from the soil. Light soils need more nitrogen

and potash than do heavy loams, but less phosphoric acid. Porous soils are the most benefited by liquid manure from stables, cow-houses, and cesspools, applied in advance of growth in the vines.

Equal parts of stable manure and turfy loam, chopped up to the size of horse-droppings, two parts loam and one part farmyard manure, or the contents of earth-closets, mixed, form good winter surface dressings. These are improved by mixing with each bushel 4 pounds of the following mixture: steamed bone-meal, 2 parts; sulphate of potash, 1 part; gypsum, 1 part. Incorporate the whole well together. Remove the loose surface soil and supply the compost 2 inches thick, or half the quantity—1 inch—may be applied when the vines are at rest, and the other half when the grapes are set.

All vine borders are benefited, except those in which the vine roots are deep, by the removal of the loose surface soil and the addition of fresh loam. When the vines are pruned and the house cleansed, scrape off the remains of previous mulchings, loosen the surface of the border without injuring the vine roots, and, having removed the old soil, supply fresh loam in its place. Where it is not convenient to apply a dressing of fresh loam 1 pound of the mixture last named may be applied per square yard, and slightly pointed into the soil. This is a handy and useful dressing for outside borders. There is no need to wash it in—the rains will do that, but when applied to inside borders, well water it in. All slow-acting manures, such as bones, kainit, and horn shavings, should be applied long in advance of growth, if they are to benefit the vines in the season following. Quick-acting manures are best applied slightly in advance of growth—say, when the buds commence swelling, and at intervals of three to six weeks, according to the size of the borders and necessity of feeding, until the grapes change colour for ripening. Guano, sulphate of ammonia, and nitrates of potash and soda must be used cautiously, especially when the roots are close to the surface, and it is safer to apply half or one-third only of a full dressing—2 ounces per square yard—at proportionate less distant intervals than to give an overdose. Nitrate of soda may be used where the soil is chalky in preference to guano and sulphate of ammonia. This fertiliser, however, must be applied to vine borders with judgment, as an aid to growth and, as a rule, not after the grapes have stoned. Soot is good for vines at the rate of a handful per square yard, but it must not be used after the time just named, or the fruit may acquire its flavour. Blood, dried and powdered, wood ashes from small twigs, and steamed bone-meal in equal parts by measure, mixed, and applied at the rate of a good handful per square yard, at intervals of three weeks, from the swelling of the buds to

the grapes changing colour, give good results. It is an all-round fertilising mixture, supplying other elements that vines need besides nitrogen, potash, and phosphate.

Of chemical manures those composed mainly of bones are most in repute for vines, and M. Ville's formula:—Calcic superphosphate (dissolved bones), 528 pounds; potassic nitrate (saltpetre), 440 pounds; calcic sulphate (gypsum), 352 pounds, mixed, per acre, is an admirable compound, especially for soils deficient in lime. The mixture equals $11\frac{3}{4}$ cwts. per acre, $8\frac{1}{4}$ pounds per rod, and about 5 ounces per square yard. If more vigour is wanted in the vines let potash predominate, that is—nitrate of potash, 528 pounds; superphosphate, 440 pounds; and gypsum, 352 pounds; this is preferable in most cases for light soils. If the vines grow too freely, increase the phosphate and diminish the potash. The following is a good general manure for vines: superphosphate, 3 parts; powdered saltpetre, $1\frac{1}{2}$ part; gypsum, $1\frac{1}{2}$ part; mix, and use $\frac{1}{2}$ pound per square yard at intervals of fourteen to twenty-one days from the vines commencing growth until the grapes change colour. If more vigour is desired, increase the quantity; if less growth is wanted, extend the intervals.

Vines in a substantial border afford excellent results from dressings of dissolved bones, 1 pound to the square yard, when starting into growth, repeating the application when the fruit is set, and again when the last swelling commences after stoning. Phosphoric acid is the chief element needing to be applied to the soil, because soils generally contain the smallest relative supply, and are, therefore, soon exhausted of phosphates. The large proportion of lime that enters into the composition of vine borders economises the use of potash, and is, to a certain extent, interchangeable with it. Grapes, however, cannot be grown without potash, and hence the need of its application in about half the quantity advised for phosphates. In some cases heavy dressings of superphosphate and muriate of potash have proved injurious by the accumulation of the acids (sulphuric and hydrochloric) by which bones and potash are dissolved. But this is rare, and can only arise through the use of bad, or the misuse of good, superphosphate. In applying manures cultivators must be guided by the nature of the soil and the condition of the vines for supporting them effectively.

The soil of vine borders, in certain cases, becomes an inert soapy mass, particularly near the surface, from the excessive use of mulchings with horse, cow, or farmyard manure, and drenchings, without discretion, of liquid manure. The result is an excess of humus and organic acids. The roots of the vines may not be absent from such staple, but they are long and fibreless, and the crops of fruit unsatisfactory. To such

borders a dressing of air-slaked lime should be applied in the autumn, and mixed with the soil as deeply as can be done without much disturbance of the roots. A covering of lime, 2 inches thick, often effects a wonderful improvement in vines that have been over-manured. Thomas phosphate (basic cinder) may be used in such cases with great advantage at the rate of 2 pounds per square yard; the chief agent wanted is lime, and of this the phosphate mentioned contains 50 per cent., with smaller proportions of other elements which are of service to vines.

Covering Vine Borders.—Where the vines are planted in outside borders, and a portion of the stem is exposed, that part must always be protected by haybands wrapped round it, and the roots near the collar should have litter placed over them. This is absolutely necessary to preserve the vines from collapse during severe frost when the sap is active. The remainder of the border, where the vines are not started before February, may be left exposed to the beneficial action of the weather. Where the vines are planted inside and forced early, the outside border should be covered with not less than 6 inches of dry oak or beech leaves or bracken, before the temperature of the soil has fallen below 50°. The covering retains warmth in the soil, especially when a thatching with coarse litter is applied so as to throw off heavy rains and snow. Borders so covered should have the materials reduced in spring, when the outside mean temperature is 50°, only retaining a little of the shortest for protecting the surface roots. Where the roots are wholly outside and vines are forced early, a continued supply of fermenting materials, such as 3 parts leaves and 1 part stable litter, should be employed on the border from the time the house is closed until the grapes are ripe; the covering must then be gradually removed, leaving a little to protect the surface roots. The fermenting materials must be renewed from time to time, so as to maintain a genial warmth in the soil; an excess of heat is highly injurious. Glazed lights placed over the fermenting materials so as to throw off heavy rains and snow are distinctly advantageous.

The borders of late vineries should be exposed until the setting-in of heavy rains in autumn, and then covered with glazed lights, or dry material, such as bracken or leaves, with the addition of tarpaulin, thatched hurdles, or wood shutters during wet periods. Uniform moisture and temperature are essential to the sound keeping of grapes; if the soil is dry they shrivel, and if constantly saturated the berries are liable to decay. In dry autumns, and where the borders are exceptionally well drained, covering them may not be necessary, and the grapes may keep sound if the wood is well ripened; but a

saturated condition of the soil in autumn is disastrous, and, as a rule, judicious protection is advised when it is desired to keep late grapes on the vines. Remove the covering before late vines are started, and expose the soil to the weather from March to October.

Resting Period.—After the leaves fall the vinery should be kept as cool as is practicable. Air ought to be freely admitted when the weather is mild, both day and night, and the house need not be closed except during severe frost. Moderate frost will do no harm to vines when resting; but when the days are bright and the temperature is raised so as to cause the sap to move, frost should be excluded. Sun heat with abundance of ventilation never acts prejudicially on vines at rest. It is the undue artificial warmth regularly maintained that causes the buds to swell prematurely. This must be avoided and as long a rest accorded as possible. The drier the atmosphere the better, but the border must not be allowed to become dust-dry or the roots will suffer; therefore keep the soil moist.

Forcing Vines for Early Grapes.—All vines grown under glass are forced, wholly in cool houses by the sun, and artificially in heated structures by the aid of flues or hot-water pipes, supplemented in some cases by fermenting materials, and always with the best of all heat, that of the sun; the more there is of this, under careful guidance, the better are the grapes. Vines have been forced so as to ripen their fruit in January; they were pruned in August and started at once, but better grapes were had by the careful keeping of bunches ripened in the autumn than those produced by this extreme forcing. Late grapes—varieties with thick skins—may be kept several months not only without prejudice but with improvement in quality, and the extreme early forcing of permanent vines is now seldom practised. To have ripe grapes in March the vines should be started not later than early November. Vines grown in pots, specially for forcing, are now employed to produce very early grapes, instead of permanent vines. These pot-vines are of no use for forcing again. A sufficient number are raised annually and grown a couple of years, to produce, as Mr. D. Thomson describes them, “canes like walking-sticks, and buds like nuts.” Maturing their growths early, they respond to heat and moisture readily at a time when the weather is most unfavourable. This forms a special branch and will be treated presently; therefore, we need only say in this place that to have fresh ripe grapes in March and April they are best secured from vines in pots.

Time Required from Starting the Vines to the Fruit Ripening.—This for Frontignan

Muscadine, and Sweetwater grapes, such as White Frontignan, Royal Muscadine, and Black Hamburg, is about five months. These and other varieties advised for early forcing, if started early in December, will ripen the fruit in May, succeeding the vines in pots; if started early in January, grapes will be ready for cutting in June; by starting early in February, they will be ready at the beginning of July; by starting early in March they will be ripe towards the end of July; and if the vines are allowed to start naturally at the end of March or early in April, they will perfect their crops in August and September. Sufficient time is thus allowed for the grapes to become mature and fit for table. Late houses of Hamburgs are sometimes retarded by free ventilation in the early stages so as to have the fruit ripe towards the close of September, or even later, but this only answers in favourable localities.

Muscat of Alexandria and all late grapes require six months for ripening, and it should always be completed by September. To have Muscat of Alexandria ripe in June the vines should be started early in December. Madresfield Court, though classed as a Muscat, will ripen with the Sweetwater grapes, and the Black Muscat ripens in advance of the Muscat of Alexandria. This grandest of all grapes can seldom be had in the best condition before July, and the vines should always be started sufficiently early for the crops to have August and September to perfect in. The more time the vines are given under solar influence the finer are the grapes and the better they will keep. All late vineries should be started in March. The vines then have the best six months for perfecting their crops. It is preferable to start them earlier rather than later, for those which start naturally late in March or early in April often require considerable fire heat to ripen the grapes, and then they do not keep well.

Vines forced for the first time do not start into growth so soon as those which have been forced the previous year. The former should not be hard forced, but given more time. There is usually a difference of about three weeks between the two in the time of the grapes ripening. Vines which have been systematically forced commence growth freely at the usual time of starting without much heat.

Watering.—The inside borders must be brought into a thoroughly moist state before starting the vines. If the borders have become so dry as to crack, they will need repeated applications of water. This should never be less in temperature than the mean temperature of the house, and it is better if 5° warmer. From the time the vines are started into growth till the grapes are perfected, there must be adequate moisture in the soil. Until the leaves attain full size the demand for water is not great, for the

plants first use up the stored matter in the stems, then push fresh rootlets, and imbibe nourishment, which the leaves assimilate freely. If the rooting medium is cold or unfavourable aërial roots are emitted from the rods and spurs.

Borders composed of light, porous materials need water twice as often as do those of medium texture, and these require water more frequently than does retentive soil. Shallow and small borders require much more water than do those which are deep and large, and its need or otherwise can only be determined by examination. The uninitiated may dig three parts through the border with a trowel, feel the soil at different depths, press a portion of it in the hand firmly, let it fall on firm ground, and if it crumble it plainly needs water. Cultivators who have gained experience in that way are able to judge of the moisture requirements of the border without disturbing it. With the roots in full possession of the soil, water can scarcely be over-supplied to vines in well-drained borders during the growing season. Those of small area and little depth, say, 15 inches, will need supplies once or twice a week, giving sufficient each time to pass through the soil to the drainage. If moderately moist one or two 3-gallon waterpotfuls to a square yard may suffice, but if dry twice the quantity will be required.

Borders of medium area and depth, say 2 feet, and of a porous nature, will need water at fortnightly intervals; whilst those that are firm and retentive may require it once in three weeks. Where the borders are large and deep it generally suffices to commence watering when the vines are in full leaf, repeating at intervals of about six weeks until the crop is ripe and the wood mature. Thus watering vine borders must be governed by circumstances, including the weather.

Early forced vines require less water than those started in March, because the evaporation is less in winter than in summer. If started at the latter time the vines require watering, as a rule, from the commencement of April at intervals of about three weeks till the end of October, and it is desirable to have the borders moist during the flowering of the vines and the ripening of the fruit. Water is seldom necessary while the vines are at rest, but on no account must they be allowed to become dry when the leaves are falling, or for some time afterwards, for the roots are then active. The crust of a vine border should be broken up to the depth of 1 inch with a fork before applying water, so that it may pass through the soil regularly. About 20 gallons of water per square yard are needed to soak a border of very dry, firm materials through to the drainage. This should be given in three or four instalments, as the water passes down, until the entire bulk of the soil is moist. Water may be given during the summer months

at a temperature of 60°, and that is as low as it ought to be used at any time. The foregoing remarks apply to vine borders under glass; but outside borders should also receive due attention, watering them during the summer as needed, this being determined by the state of the soil.

Temperature.—At the start the temperature should be 50° at night, 55° by day, advancing to 65° from sun-heat, as registered by a shaded thermometer. When the buds swell, gradually raise the temperature to 55° at night, and 60° to 65° by day, and when the vines are fairly growing increase the heat so as to have the night temperature 60° by the time they are in leaf, 65° by day from fire heat, and 70° to 75° from sun. Raise the heat to 65° to 70° at night when they come into flower, 70° to 75° by day, and 75° to 85° from sun heat. After flowering and setting let the temperature be 60° to 65° at night, 70° to 75° by day, and 80° to 85° or 90° from sun heat. It is at this stage when the size of the berry is, in a great measure, determined; for a good first swelling in the short time elapsing between the flowering and the stoning helps immensely towards large berries. Therefore, aim at a rise to 70° soon after daylight, and if the weather is mild 5° more. With sun heat a day temperature of 80° to 85° should be the rule, and a further rise of 5° or 10° after closing in the afternoon is admissible; also a little fire heat in the latter part of the day, to prevent the temperature falling lower than 75° till within an hour of sunset, after which it should gradually decline so as to reach the minimum about midnight.

When stoning commences, about six weeks after flowering, or a fortnight sooner in early varieties, the berries apparently cease swelling, and no good comes by hurrying them; therefore, keep the heat steady at 60° to 65° at night, 70° by day without sun, but allow a rise of 10° to 15° from sun heat. Nothing is gained by early closing so as to raise the temperature at this stage; but in a month or less there will be signs of renewed swelling, and early closing may be practised as before, till the grapes show signs of colouring, when the early closing should be discontinued, and the temperature gradually lowered after the fruit is thoroughly ripe. In the case of early forced vines the temperature must not fall below 55° or 60° after the fruit is cut, for a low temperature induces rest and the premature casting of the foliage, which should be retained in a healthy condition as long as possible; otherwise the vines may start into growth when they should be going to rest in September. In the case of Muscats and thick-skinned grapes that are fully ripe in September, the temperature may be gradually lowered to an even one of about 50°, and this may

be continued for about two months, or till the growth is ripe and the leaves commence falling.

Muscat of Alexandria and all the shy-setting grapes require a somewhat high temperature at the flowering period, say 5° more than for Black Hamburgh; and all late grapes need a moderately high temperature to be continued for a longer season than other varieties. After the stoning is completed—say, early in July—there should be a natural rise of 10° higher than the maximum advised, namely, 80° during stoning, and with free ventilation it will enlarge the berries.

Ventilation.—The admission of air in the case of early forced houses up to the time of the vines flowering is only for the prevention of too high a temperature, and there is generally a sufficient interchange of air between the laps of the glass to sustain healthy growth. When the inside and outside temperatures are nearly the same, as occurs in mild, dull weather later in the season, the air becomes almost stationary, and it is then advisable to use a little extra fire and ventilation to effect a change of air daily. During the flowering period, and after colouring has commenced, a “chink” of air is necessary constantly, especially in houses with large panes of glass and close laps, and it is important to increase the ventilation early and gradually, to prevent the temperature rising to a dangerous height when the sun shines powerfully. The ventilators should be opened on the side opposite to that from which the wind comes, when it is rough and cold. The point to remember is this—admit air early, and let the rise of temperature nearly all take place afterwards. Those not experienced in the management of vineries should admit a little air as soon as the sun touches the glass; then if the heat rises give a little more. Watch the thermometer, and as the temperature increases admit more air, till the amount required for the day is reached. Difficulties in ventilation arise during alternate sunshine and cloud. The weather should as far as possible be anticipated, and the air reduced a little before rather than after the obscuration of the sun if it is likely to be clouded for some time; and it is necessary to be on the alert when the clouds diminish, so as to be slightly in advance of the sunshine in re-opening. In extremely changeable weather it is best not to aim at a high temperature during the early part of the day, but merely keep a safe one, and then, unless the vines are in flower or the grapes colouring, close early in the afternoon, and allow the highest temperature which is considered safe. If by accident or neglect the temperature rises too high before air is admitted, it must on no account be lowered by full ventilation, but air should only be admitted to prevent a further rise,

and the floor of the house moistened. When the vines are flowering it is advisable to have the ventilators slightly open at all times to maintain a buoyant atmosphere and favour fertilisation. When the grapes commence colouring air must be freely afforded both day and night. During other periods of growth a little air should be admitted by the top lights as soon as the temperature has risen to the required artificial maximum, and this ventilation should be increased as the heat advances, and after midday be reduced gradually, so as to close early and conserve the sun heat to secure a long day's work for the vines.

Moisture.—In the early forcing of vines it is advisable to syringe them several times a day in bright weather, but much less frequently on dull days, and always early enough in the afternoon to allow them to become fairly dry before nightfall. The higher the temperature the greater the syringing required. The first syringing should be given soon after the temperature rises in the morning, repeating early in the afternoon, if not sooner, and always at closing time. Keeping the rods moist favours a good break. Syringing may be continued until the bunches are visible in the points of the shoots, and should then cease or the foliage may be spotted by the substances the water holds in solution, and besides, much moisture on the leaves weakens their tissue. With command of clear rain-water, however, syringing may be practised early in the afternoon or at closing time until the vines come into flower, when it must cease. After the berries form, the vines may be syringed two or three times, to cleanse them of the remains of the flowers. The syringe should then be laid aside till the grapes are cut, then freely employed again to cleanse the foliage of dust and insects, for it is imperative that the leaves be kept clean and healthy until they ripen.

Damping down, or sprinkling the paths and borders with water for the purpose of creating a moist atmosphere, requires to be done at least twice a day in early forcing. In bright weather walls, floors, and borders should be damped in the morning, at closing time early in the afternoon, and again before nightfall. In dull weather less moisture is needed. Atmospheric moisture is essential to prevent excessive evaporation from the leaves, to prevent attacks of red spider and thrips, and to insure the free swelling of the fruit. The greatest benefit is derived from damping immediately after closing the house early in the afternoon. It is not desirable that the floors and borders be continually moist, but the surfaces should become dry occasionally, damping those near the hot-water pipes more frequently than the cooler parts of the house. Aëration of the border is important, and, therefore, it is best to allow its surface to become dry

sometimes, and then it is damped to the greatest advantage. Moisture is as necessary when the vines are in flower and the grapes ripening as at any other time, and extra ventilation effectually prevents any consequences unfavourable to the setting or keeping of the fruit. Even a moderate amount of atmospheric moisture is essential to the sound keeping of early grapes, while it preserves the foliage in health; but the air must not be still, nor moisture be deposited on the berries. A somewhat drier atmosphere is required when the grapes are colouring, and by the time they are ripe the moisture arising from the border will be sufficient for late grapes. When these are fully ripe what is known as a dry atmosphere should be maintained by judicious ventilation and warmth as may be needed in the hot-water pipes.

Mulching.—Instead of covering vine borders with stable or farmyard manure, as was formerly done, often to a depth of a foot, to become a soapy mass and deprive the soil of air, it has become the practice to use none. This is going from one extreme to the other, and is a mistake. A judicious dressing of manure induces the emission of numerous feeders near the surface, and not only enriches the soil, but prevents evaporation. Vines in the best condition have plenty of fibrous roots just under the surface of the soil, and they should be as abundant near the stem as anywhere. To keep them there depends upon the sustenance provided. For light and poor soils, $\frac{1}{2}$ -bushel of short farmyard manure or lumpy cow manure per square yard, applied when the vines are in leaf, and renewed from time to time as required to maintain the thickness, not increase it, until the grapes commence colouring, is highly beneficial. Heavy soils are best mulched with horse-droppings, sweetened before placed on borders inside the house. Soil passed through dry earth-closets, with a couple of good handfuls of wood ashes, and a similar quantity of steamed bone-meal mixed in every $\frac{1}{2}$ -bushel, forms an excellent top-dressing, applying that quantity to the square yard about a month prior to the vines starting into growth and covering it lightly. Where manure has been used as a mulch, enough air-slaked lime to make the border evenly white may be advantageously employed in the autumn, lightly pointing it in, and it is better to do this every year than supply heavy dressings at distant periods.

SPRING AND SUMMER ROUTINE MANAGEMENT.

Disbudding, Stopping, and Tying.—As soon as vines have fairly started into growth some of the shoots will require removal. If this is done as early as possible they may bleed a little, but it is desirable to wait only till the best bunches can be dis-

cerned in the points of the shoots, and then rub off those growths not required. The shoots should be 15 to 18 inches apart on each side of the cane or rod. If two or more shoots start from a joint select the best one and rub off the rest. Where more than one starts from the same spur the choice should be given to the one nearest the main rod if it is healthy and fruitful. Regard must be had to what has been advised on this point under "Training," and two shoots may be left when there is ample space for leaf development (see page 283). When the bunches of fruit are fairly visible, disbudding is readily performed, and there is then little danger of bleeding. Healthy vines will show two or three bunches on each shoot by the time it is 2 or 3 inches long, and one of these only should be left, preferably the one nearest the base if it is a good one, always retaining the best. Persons who are not experienced in grape growing should wait a little longer to make sure of the most shapely bunches.

A few days later stopping the shoots becomes necessary, and should be effected in such a way as to give the least possible check to the vines. Stop the strongest first, leaving the weaker ones to grow unchecked for a while. But it must be the merest point that is taken out before the leaf at the joint exceeds the size of a shilling, and care is required to do it properly. Beginners will be assisted in the work of manipulating vine shoots by the illustrations on page 299.

The leaves near the point of the shoot at the time it is stopped are scarcely large enough to be called leaves, but they are sufficiently so for their number to be counted. Two should be retained beyond each bunch, and four may be allowed if there is room for them to develop and allow some sub-lateral growths without any crowding. The extension tends to increase the root action, and the fruit has then a less exhausting effect on the vines. In some instances vines are so closely trained that it is necessary to stop at one leaf beyond the bunch, and it is better to do so and allow space for after-growth than to permit the crowding and crushing of the foliage, for in such case all the leaves are imperfect. One substantial leaf grown under the direct action of the sun is more effective in supporting the vine and crop than half a dozen that are essentially faulty through being shaded by overcrowding. No more main leaves, therefore, should be allowed beyond the bunches than can have full exposure to light and air, allowing also space for subsequent growths, next to be explained.

Small shoots, called laterals, will start from the axils of the leaves, and they should be stopped to one leaf. This will cause the uppermost or side bud at that joint to push a shoot, termed a sub-lateral (Fig. 90, *O*, *l*), and this also must be pinched to one leaf.

Indeed, all sub-laterals should be kept stopped to one leaf, as it commences to unfold, as shown in Fig. 90, *P, q* (next page), in which four stoppings are indicated. If the bearing shoots are a good distance apart, all the laterals (*N, f*) below the bunch, as well as those above it, may remain to be pinched (*N, e*); but where they are likely to interfere with the principal leaves they may be removed entirely to the bud at the base, except two nearest the main rod (*N, g*). The basal buds—indeed, all buds to which it is intended to prune—must be supported by the laterals that proceed from their side, taking out their points and those of the sub-laterals that follow, as previously referred to. The stopping of laterals should be done early, with the finger and thumb; the sap is then concentrated on parts where it will most benefit the grapes, also the vines for the succeeding year's crop. The way to ruin vines is to let the growths interlace into a thicket and then cut out large quantities at once. It is much better, if, through any cause, growth extension becomes excessive, to proceed gradually with the thinning than to remove armfuls at a time, and if the grapes are near ripening, the confused shoots may be left until the grapes are quite ripe; then the spray may be removed by little and little until light reaches the wood for the maturation of the leaves and buds.

Tying-down.—This must begin before the shoots come into contact with the glass. This is important, as those which touch the glass may be destroyed, and the crop for the year lost by a single night's frost. Where the trellis is near the glass there is also danger of losing a spur in consequence of the shoot being forced from its socket if drawn down a little too far at the first tying; therefore proceed with caution, only drawing the shoots down sufficiently to prevent their reaching the glass again for the next few days. They require daily watching to bring them into the required position without mishap. It is necessary to go over the vines about three times, drawing the shoots down a little every three or four days, and having them in position before the vines come into flower. The evening is, perhaps, the most suitable time for doing this work. In the morning the shoots are brittle, but with care they may be brought down, and the sun toughens them so that they do not break. In the daytime the shoots are limp and more readily tied, yet too great tension must not be put upon them in bringing them down, for they become stiff at night, and in the morning some are perhaps snapped or parted at the sockets. Judgment is necessary to tie vine shoots safely, and the more vigorous they are the more careful must be the operator. Gros Guillaume, Gros Maroc, Alicante, Trebbiano—all the stiff or brittle-wooded kinds—are the most liable to snap or be forced from the sockets. Allow sufficient room in the ligatures

for the shoots to swell and extend through them, and where the extension growths fork



Fig. 90. BEARING-SHOOT, LATERALS, SUB-LATERALS, AND FORKED GROWTH OF VINE.

References :—N, bearing-shoot : a (top), pinched four leaves beyond the selected bunch (j) ; b, stopped two joints beyond the fruit ; c, tendrils or small bunches removed ; d, lateral unpinched ; e, laterals pinched ; f, joints from which the laterals may be removed ; g, joints where the laterals must remain ; h, bunch with large shoulder forming an uneven cluster (removed) ; i, close-set bunch (removed) ; j, bunch with good shoulders (retained). O, joint of bearing-shoot ; k, lateral pinched ; dotted growth (l), sub-lateral. P, joint of bearing or other shoot : m, main leaf nourishing the bud at its base (n) ; o, lateral pinched to one leaf ; p, sub-laterals, stopped to one joint at + + ; q, portion desirable to remove. Q, forked growth ; r, leader ; s, part to cut off.

remove the worst (Q, s, Fig. 90). If the leader becomes "blind," that is, has the

point composed of small leaves and tendrils, cut it to a joint with a sound bud, and take the lateral forward as leader.

Setting the Grapes.—With the vines in good condition there is little difficulty in securing a good set of fruit with most varieties. Muscat of Alexandria and all the shy-setting varieties require as much light as possible during the flowering stage, and it may be desirable to tie a few of the leaves back that shade the bunches. This particularly applies to Muscats, and they require a temperature of 70° to 75° at night, with a rise of 5° from fire heat on dull days. Both top and bottom ventilators should be left slightly open—a mere chink—during the flowering period, except when cutting winds or night frosts prevail. Damping down may be done in the morning and afternoon, but a dry atmosphere is necessary in the middle of the day to have the pollen in the right condition to effect fertilisation. When the flowers commence throwing off the “caps” every bearing shoot should be sharply tapped with a stick at midday, when the pollen will be distributed over the stigmas of such flowers as are then exposed. To remove the caps the hand may be gently drawn over the bunch, especially at the point. It is absolutely essential to fertilisation that the pollen come into contact with the stigma of the flower; this is effected naturally by the dislodgment of the cap, the anthers pushing it off, and the jerk causes the pollen to be dispersed. Self-fertilisation is thus easily accomplished; but artificial impregnation is necessary with some grapes, and always in crossing for raising new varieties.

Fertilisation is readily effected when the stamens are erect and cluster round the stigma, as in Fig. 91, *S*; but with the stamens deflexed, as in *U*, bad setting results unless pollen is applied to the flowers. This may be done with a large camel's-hair brush, or a rabbit's tail mounted on a stick, lightly sweeping the bunches when in flower, and if they contain pollen, the brush will be charged with the yellow powder. It is then only necessary to pass it over the stigmas wherever the flowers are fully developed. Where there is a deficiency of pollen it should be taken from varieties that afford it abundantly, such as Black Hamburgh. It is well in all cases of shy setting to brush the bunches over for the removal of the “caps” or the drops of glutinous matter which sometimes adhere to the stigmas before the flowers are touched with the pollen. The forenoon—never later than midday—is the best time for pollenisation as suggested, continuing it from day to day till all the flowers are fertilised. Alnwick Seedling requires particular attention in the application of pollen from another variety, and ought never to be neglected, nor should Canon Hall, Muscat of

Alexandria, Black Muscat, Mrs. Pince, and Lady Downe's. Madresfield Court requires attention in fertilisation at the points of the bunches. Mrs. Pearson, and large bunches of Gros Guillaume, also Syrian, should be brushed over so as to distribute the pollen to every part. Shaking answers in most cases for all but the bad setters, and no means should be neglected to insure a good set of fruit, otherwise the bunches cannot be shapely or the crop satisfactory. Royal Muscadine, Black Hamburg, Alicante, Gros Maroc, Gros Colman, and Trebbiano are free-setting varieties.

Vines in good health set their fruit the best, the plethoric and sickly the worst. The all-important point is good wood, thoroughly ripened; this can only be produced

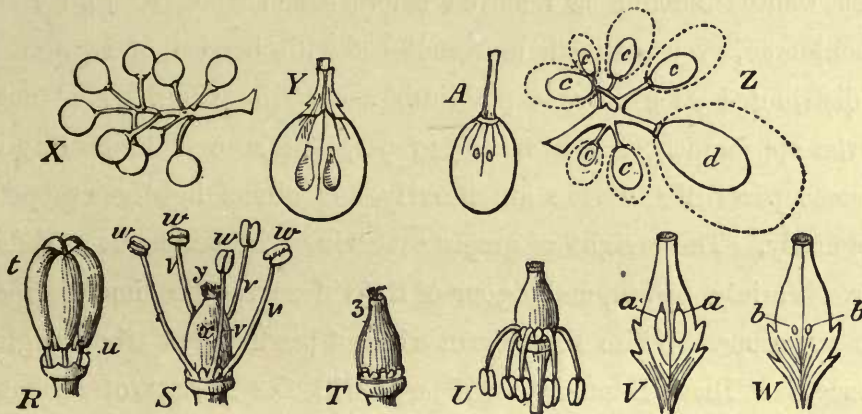


Fig. 91. FLOWERS AND BERRIES OF THE GRAPE VINE.

References :—*R*, flower casting the corolla or "cap," *t : u*, time and place of cutting off the stamens to prevent natural and to effect cross fertilisation. *S*, flower after the "cap" is thrown off : *v*, stamens ; *w*, anthers ; *x*, ovary ; *y*, stigma. *T*, flower prepared for cross-fertilisation : *z*, part to which the pollen is to be applied. *U*, flower with deflexed stamens, bad setting. *V*, section of ovary : *a*, ovules perfect, the berries setting if fertilised with effective pollen. *W*, section of ovary : *b*, ovules imperfect—berries cannot set. *X*, berries showing by even swelling that they are fertilised. *Y*, stoned berry. *Z*, berries badly set : *c*, stoneless ; *d*, with stones—the dotted outlines indicate relative size of the berries when ripe. *A*, section of stoneless berry.

by affording the growths abundance of light, feeding the vines, and keeping the foliage clean. The bunches for the coming year then form in the buds, without which it is useless expecting flowers with the essential organs of fertilisation, and in the absence of these, though bunches may form, there can be no fruit.

Thinning Grapes.—The berries are thinned to secure even-sized and large grapes. Early thinning secures the best results ; when the work is deferred till the berries press against each other, it can only be done slowly, and never well, while the then large berries cut out represent so much loss of the vine's resources. Some varieties, such as Lady Downe's, may have the flower buds thinned, taking out those with weak footstalks, and the rest will be strengthened. Other varieties, such as Gros Colman

and Trebbiano, may be thinned whilst in flower with a view to securing the largest berries in handsome bunches for exhibition. All the free-setting varieties, such as Black Hamburgh, are usually ready for thinning in about ten days after the first flowers open. Muscat of Alexandria and all shy setters should be left till the fertilised berries approach the size of small peas, for making sure of a sufficient number for swelling evenly to maturity. Characteristic examples of setting and thinning are shown on the next page.

Experienced growers cut off the surplus bunches before the flowers commence opening, leaving the best shaped with fine even flower buds, and in any case the bunches not wanted should be removed before commencing to thin those retained—sturdy-shouldered, even-outlined, and well set with berries of regular size. They should be distributed as evenly as practicable over the vines. This not only adds greatly to the appearance of a house of grapes, but secures uniformity in ripening, for, when some parts of the vine are heavily and others lightly cropped, the fruit finishes irregularly. The weight of grapes each vine will perfect is a difficult matter to determine. Variety, health, and vigour of the vine, and the time of ripening, exert influence on the crops. White Frontignan will not produce half the weight of grapes, space for space, that Black Hamburgh will, nor will the Muscat of Alexandria afford such a heavy crop as Foster's Seedling. Vines in the best condition will perfect double the weight of fruit of weakly ones. Vines forced to ripen the fruit in March and April produce a crop one-third less than those which ripen their crops in May and June, and these in turn cannot afford nearly the weight of fruit of those which ripen their crops in August and September. Ill-fed vines may languish under a burden of $\frac{1}{2}$ pound of fruit to every foot-run of rod; well-fed vines will finish 1 pound of grapes perfectly on the same length. A vine finishes a greater weight of fruit when the bunches range from $\frac{3}{4}$ to 2 pounds each, than when the bunches are four to six times as heavy. Medium-sized compact bunches invariably finish the best. With the bearing shoots 18 inches apart alternately on the sides of the rod, $\frac{3}{4}$ pound weight of fruit (Black Hamburgh) to each lateral is a good crop; if the bunches are likely to reach $1\frac{1}{2}$ to 2 pounds, one such bunch to every other bearing shoot is sufficient. This is equal to about 1 pound per foot of rod, but some vines perfect much heavier crops, and regard must be had to the distance the rods are apart as well as to the variety. Black Hamburgh with 4 to 5 feet between the rods affords as great a weight of fruit as Muscat of Alexandria grown $7\frac{1}{2}$ feet asunder. Growers must

exercise judgment in cropping vines, and if they err at all it should not be in over-cropping them

Early in the morning and during the evening is the pleasantest time to thin grapes.

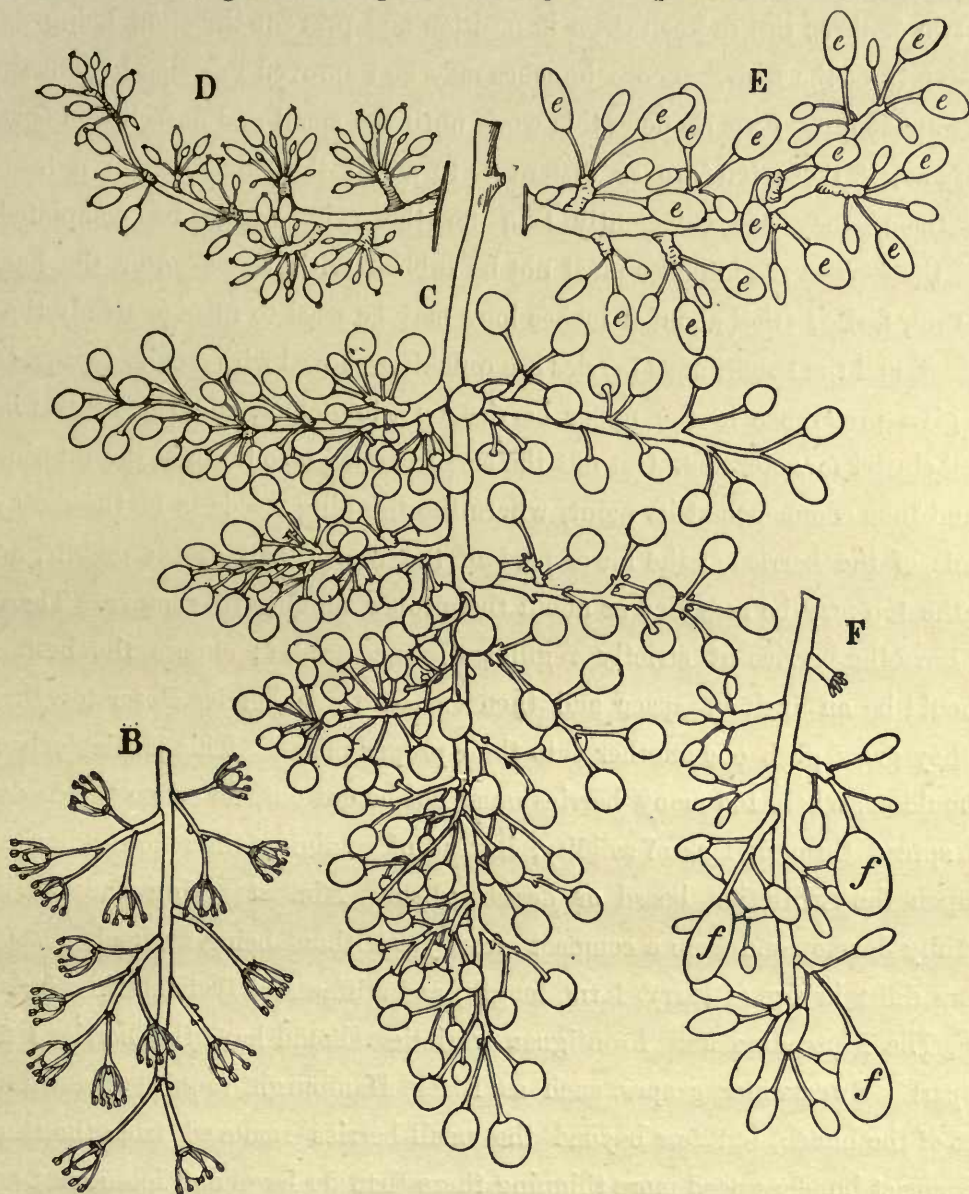


Fig. 92. GRAPES AT THE THINNING STAGE.

References :—*B*, branchlet of Gros Guillaume in flower : left-hand side unthinned ; right-hand side thinned. *C*, small bunch of Black Hamburg : left-hand side before thinning ; right-hand side after thinning. *D*, branchlet of Muscat of Alexandria set fairly well. *E*, branchlet of Muscat of Alexandria with berries of thinning size : *e*, fertilised berries ; all the other berries stoneless. *F*, branchlet of Muscat of Alexandria set badly : *f*, fertilised berries that alone swell to full size.

Small and medium-sized compact bunches seldom require the shoulders to be tied up, for the berries as they swell raise each other, and the bunches remain even in outline

and compact. Large bunches are much improved by tying up the shoulders. They are secured with twisted strips of raffia from the shoulder to the trellis, taking care to leave sufficient space in the loop, and to let the shoulders hang easily. Long branchlets require two or three ties to keep them in position and prevent the stem being damaged by the weight of the fruit. Loose bunches may be improved in shape by crossing the shoulders at the top. Experts defer this work until the small and unfertilised berries are removed, and, if those left are so distant as to admit the thick end of a lead-pencil between them, they are sufficiently thin for the tying-up to be completed. In thinning the berries the bunches must not be rubbed with the head or the hand. A smooth, thin, forked stick about 6 inches long may be used to raise or steady the bunch or branchlet, and the superfluous berries are quickly removed with a pair of grape-scissors. Always give preference to the upper berries on a branchlet, and the central berry of each small cluster for retention. Cut out the small berries, also those in the interior of the bunch, and then commence at its point, where the thinning needs to be the most severe. Two-thirds of the berries at the lower part of the bunch, half at the middle, and one-third at the top may be regarded as about the proper number to remove. There is no need to have the berries at strictly regular distances apart; choose the best, and if there should be an inch of space and then two or three berries closer together, they will as they grow push one another into their proper places. This particularly applies to the shoulders, where too many berries must not be cut out, for when this is done the bunches spread through lack of solidity, instead of retaining their form when cut and placed upon the exhibition board or dessert dish. Aim at giving the berries just room to fully develop and form a compact mass, yet without being wedged.

Grapes differ in size of berry, form, length, and stiffness of footstalk in nearly every variety. The Muscadine and Frontignan varieties should have the berries left about $\frac{3}{4}$ inch apart. Sweetwater grapes, such as Black Hamburgh, require free thinning at the point of the bunch, but few beyond the small berries removed from the shoulders, yet all compact bunches need more thinning there than do large and loose ones. Buckland's Sweetwater merely requires to have the small berries taken out; Foster's Seedling needs free but not over thinning, as the berries are oval. Muscat varieties require the greatest care, first taking out the stoneless berries when the fertilised ones are the size of peas; then thin the rest that need removal for securing full uniform bunches; leave the berries a little closer around any gaps, and such will probably be quite filled by the time the grapes are ripe. Muscat of Alexandria, Canon Hall Muscat, Black Muscat and

Mrs. Pince require special attention to secure compact bunches. Madresfield Court should have nearly all the berries removed from the centre of the bunch, as they have not room to develop there, and are difficult to detect should cracking take place. The berries, being long and tapering, do not require such severe thinning as the large round-berried varieties. Vinous grapes are generally large. Gros Colman ought to have the berries thinned to $1\frac{1}{4}$ inch apart; Gros Maroc to about an inch at the point of the bunch, but more sparingly at the top, as the footstalks are longer there. Alicante and Lady Downe's have short footstalks, which do not lengthen out, and the berries ought to be thinned to about 1 inch apart. West's St. Peter's should be left a little closer, also Gros Guillaume and Trebbiano, when the bunches are large. Bunches intended for late keeping should be more freely thinned (leaving few berries in the centre) than those for early use.

After all the bunches have been thinned they will require looking over again to give more room to the berries if needed, and to cut out any small ones which have escaped observation at the first, as these, if left, spoil the appearance of otherwise handsome clusters, because the berries are not even-sized. Some growers loop up the shoulders with S-shaped pieces of thin galvanised wire; others prop them up with bits of lath notched at each end, supplied when they are retained by the weight of the berries. We have said that late grapes intended to be kept as long as possible ought to be thinned the most freely, but no bunch should ever be so loose that, when cut and laid on its side, the berries roll out of their places.

Scorching.—Cultivators may have noticed a beautiful dew on grapes, also sometimes on the edges of the leaves, on a fine morning. This is a good sign, showing that the night temperature has not been too high, and that the vines have been invigorated and refreshed ready for the work they accomplish under the influence of light. There is no harm whatever in the dew, but its evaporation is often attended with damage. The foliage and fruit, being cooled throughout by the comparatively low night temperature, does not get warmed nearly so quickly as the close, moisture-laden atmosphere does by the great and sudden increase of heat from the sun, and the result is scorched leaves. Air is the preventive of scorching, and if admitted so that the moisture is steadily dissipated, the sun will not injure vines. When ventilation is neglected till there has been a great rise of temperature, air must not be admitted in a large volume, or the outrush of the heated and the inrush of cold air will dry the atmosphere and produce a chill, thus crippling the foliage, stagnating its tissues, and causing warts, whilst the berries may

be rusted, or their tender skins affected so as to invite mildew. Ventilate early and carefully to avoid these evils.

Scalding.—This is generally caused by a low night temperature, with the consequent deposition of moisture on the berries, and its rapid evaporation from their tissues by the sun. There are, however, two kinds of “scald,” one on the upper side of the berries of Muscats exposed to the sun, which causes the part to shrink and become brown; the other may occur on the lower side of the berries of Lady Downe’s, and sometimes over the whole berry. Gentle warmth in the hot-water pipes, a little air at night, with free ventilation by day, form the best routine for preventing the evil, but it is not always effectual with Muscats, for when the weather has been dull and suddenly becomes bright, the skins of the berries are too tender to bear the full force of the sun in structures with large panes of clear glass. A double thickness of herring or single pilchard netting drawn over the roof lights is necessary, in some cases, to avoid the scorching of the berries on the upper side of the bunches. With a temperature of 65° to 70° night and day by artificial means, and not exceeding 80° with sun without full ventilation in the last three weeks of the stoning process, scalding is avoided, for when the berries change colour they are safe. Grapes must not be hurried in stoning.

Rust on Grapes.—This is the result of injury to the skin of the berries whilst tender, hardening it so that they swell irregularly, giving them a rusty appearance, and greatly detracting from their value when ripe. It may be caused by brushing the bunches with the hand to secure a better set of berries when that is roughly done, or rubbing them with a hat or the hair of the head. These are causes of disfigurement in grapes and should be avoided, but rust is the most common in houses where the heating and ventilation are badly conducted. Over-heating the pipes so as to produce a dry atmosphere, with or without fumes from sulphured pipes, is the most frequent cause of rust in early houses. Inefficiently heated houses should have more piping and it should be spread more so as to radiate the heat at a lower temperature and more equally. Grapes are often rusted in the immediate neighbourhood of the hot-water pipes and nowhere else in the house. That means over-heating or sulphuric fumes. Avoid the use of sulphur on the pipes whilst the grapes are young. A sudden check is another great cause of rust. Allow the temperature to rise from sun heat to a high degree in the morning without air, then admit it in quantity so as to cause a cold draught, and the consequence is rusted berries, generally on the side from which the draught is fiercest. Rust prevails on outdoor grapes because the atmosphere has been warm and

moist, and is followed by a period of cold and dry weather—check to growth, contraction of the skin—rust. Prevention of rust must be sought in careful management.

Warts on Vine Leaves.—This affection seriously cripples the leaves and hinders the due performance of their functions. It is caused by a sudden exposure of the young growths to cold and dry air after they have been made in a close and warm atmosphere excessively charged with moisture. Small green excrescences form on the under side of the leaves, and the upper surface is furrowed and uneven. It is not an indication of ill health, but of irrational treatment. Therefore, avoid late and imperfect ventilation on bright mornings, admit air carefully on the return of bright weather after dull periods, and when the external air is sharp, do not allow it to drive full upon the foliage nor produce cold dry currents.

Colouring Grapes.—This commences with the last swelling. Air without a cold draught is the chief essential. Sufficient healthy foliage, fully exposed to light and air, is also an important factor in the colouring of grapes. Upon the amount of chlorophyll, formed by the foliage from the unfolding of the buds to the berries showing colour, depends the dense black of dark or the rich amber of light grapes. It is too late to seek colour when the grapes are ripening on vines that have had the foliage crowded, or when it is thin by too rapid forcing, insufficiency of nourishment, or exhausted by red spider, or when the vines are overcropped. Hamburgs require about six weeks to ripen thoroughly when colouring has commenced; Muscats take nine weeks to finish. Thick-skinned grapes continue swelling after the colouring appears perfect, and require three months from the first tinge of colour to complete the ripening process.

It is an imperative necessity to retain the earliest developed foliage on Muscats as long as possible consistent with the ripening of the wood. The best way to effect this is by maintaining a genial atmosphere, and say a minimum temperature of 65°, with the usual rise by day, the damping and watering to be done in the same way as during the earlier part of the season. Suppose the grapes commence colouring at the end of July, this treatment should be continued till October, when a little less heat, say 60° as the minimum, will suffice. Early in November the temperature should be 55° at night, and so continue until the leaves fall. This, in the case of Muscat of Alexandria started in March, occurs about the middle of December. We allude in a special manner to the autumn treatment of this most valuable grape, because when

the foliage shows signs of drying up round the edges the mistake is made of concluding that its work is done. Such is not the case, for whilst there is any portion of green leaf left, it is capable of doing something towards perfecting the fruit.

EXHIBITING GRAPES.

In setting-up grapes in competition for prizes at shows, they are not always displayed to the best advantage. Promoters of fruit shows should name the size of boards upon which the grapes are to be exhibited. A "regulation" size is somewhat difficult to determine, owing to the difference in the size of the bunches, but some well-defined standard of setting-up should be insisted upon. The bunches should rest on a slanting board (angle, about 45°) of such length and breadth as to have a clear margin all round and between them, this board to be covered with cotton wadding,

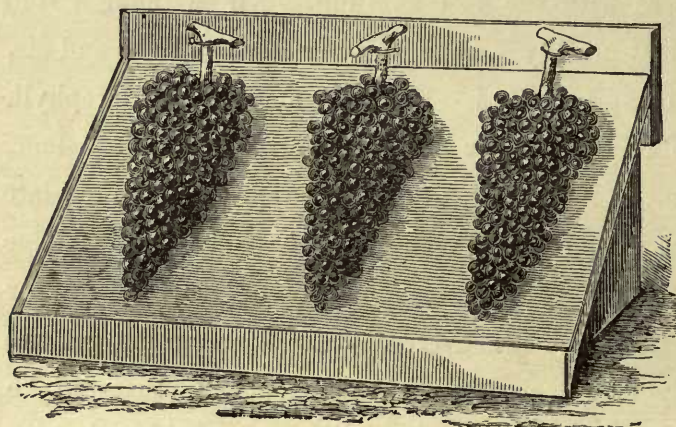


Fig. 93. EXHIBITION GRAPE STAND.

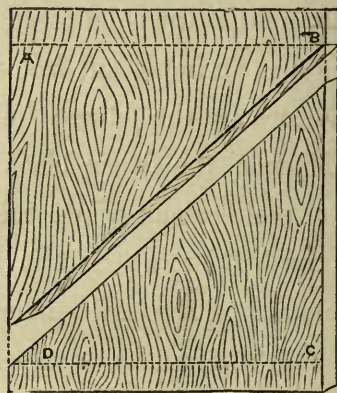


Fig. 94. PREPARING BOARD, FOR EXHIBITION GRAPE STAND.

and over this a sheet of soft white paper. Each bunch should be cut with not less than 1 inch of the shoot on each side of its stem, and secured with a piece of soft string or narrow tape passed through a hole near the top of a back perpendicular board, and fastened there. A piece of soft tape worked with great care between the berries near the middle of the bunch with a long needle, passing each end of the tape through holes previously prepared on each side of the main stem of the bunch, and tied underneath (the shoulder also if needed), will prevent its moving. Each bunch is best set up just as cut, always laying it on its flattest side. Never lift a bunch after it is laid on the board, nor handle it in any way. Place the bunch in a box just wide enough to take in the stand, and deep enough to clear the fruit when the lid is screwed on; then put a couple of screws through the box from the outside into the back board of the

stand, and it cannot move. With care in keeping the box level, right side up, and not jolting it severely, the grapes may be taken any distance without disturbing the bloom.

Mr. R. Inglis, in *The Journal of Horticulture*, Vol. VII., third series, page 546, gives the following directions for making a good and simple form of box, represented in Fig. 93, preceding page.—“Take a piece of $\frac{3}{4}$ -inch deal, 10 inches wide by 12 inches long, cut it perfectly square at both ends, draw a pencil mark to correspond with the dotted lines in Fig. 94, each 1 inch from the ends and parallel with them. This leaves the spaces *A*, *B*, *C*, *D*, a square 10 inches each way, and if cut through with a saw from *B* to *D*, and set on its square, they will be of the desired angle [45°]. Upon these fix

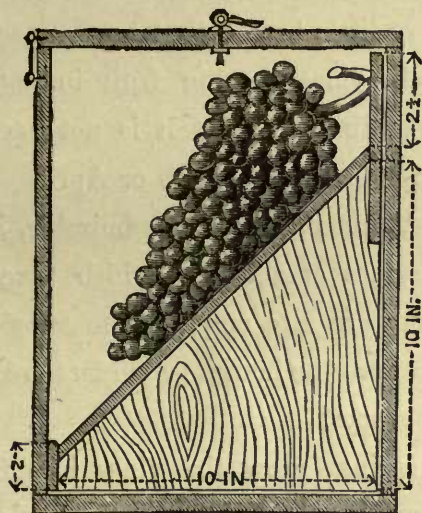


Fig. 95. EXHIBITION GRAPE STAND IN A BOX.

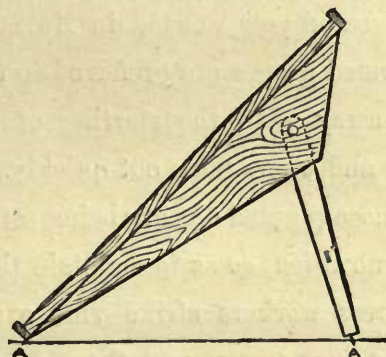


Fig. 96. BOARD EXHIBITION STAND.

the board ($\frac{3}{8}$ inch thick) for the grapes to rest upon, which for this size will have to be about 14 inches wide. Another piece of deal ($\frac{1}{2}$ inch thick) 6 inches wide is fixed at the back of the stand, and rises $2\frac{1}{2}$ or 3 inches above it, pierced with two holes opposite where each bunch is to be placed, by which means it is secured with twine or tape. A very thin lath about 2 inches wide is fixed along the front, its upper edge rounded off and standing a little above the board, and similar pieces at each end forming a narrow beading all round make the stand look neat. As to length, each bunch should have 8 or 9 inches of board; thus a box for three bunches should be 27 inches.

“Fig. 95 shows the stand in a box ready for travelling. It should be just large enough to hold the stand, should be light, and have a handle fixed in the centre of

the top to carry it by. The figures added to Fig. 95 are the measurements of the stand, Fig. 93, in section.

"Fig. 96 is a simple form of stand, supported behind by two legs connected by a lath, and generally held in position by a piece of twine, but instead of that it would be preferable to have short spikes at *A A*, so that when on the table it can be placed at any desired angle, the spikes keeping it from slipping about. This can be placed in a box the same as in Fig. 95, the legs of the stand being laid parallel with the board."

FRUITING VINES IN POTS.

Abercrombie, in 1770, mentions vines grown in pots, which, if placed in a hothouse in December, "bear fine early grapes with but very little trouble." The *Transactions* of the Horticultural Society state that one-year-old vines bearing fruit in pots were exhibited in London in 1818, and considered extraordinary. Now it is not uncommon to see vines in pots, started in November, with ripe grapes in March or April. Where thin-skinned grapes are preferred to thick-skinned, this procedure is admirable, because it does away with the starting of planted-out vines at a season which taxes their energies and wears them out quickly. Potted vines are also employed to supply fruit whilst those planted-out are being established, or where the houses or borders are undergoing renovation, so as to maintain the supply of grapes.

Express workers strike vine eyes in early spring, grow the vines into fruiting canes the same season, rest them a few weeks, start them in November, and place ripe grapes on the dessert dish in the March or April following. This entails great care and attention with no little skill to accomplish, and is the reverse of economical. The easiest way to secure sturdy vines for fruiting in pots early the following year is that first practised by Mr. W. Miller, gardener at Combe Abbey, Coventry, described and shown in Vol. I., page 103. The most general plan is to grow the vines raised from "eyes" one year, cut them down to two buds, re-pot, and grow them into fruiting canes in the second year. Such are termed "cut-backs," two-year-old vines, and these are the cheapest and best.

The propagation of the vine from an eye, and its treatment up to placing it in a 5-inch pot, are given on page 244, and shown in Fig. 74. At this stage it may be taken in hand for growing into a fruiting cane the first season; but as it differs little in requirements from that of the cut-back, it is only necessary to state that it should

be shifted from the 5-inch pot to a 7-inch directly the roots have reached the bottom and sides of the pot, from this to a 9-inch, and from that into an 11-inch pot, for fruiting.

The "cut-back" (*G*, Fig. 78, page 261) will be in a 5, 6, or 7-inch pot, as advised for rearing a planting cane, page 245, and being placed in heat not later than early February, it will start into growth, and should be turned out of the pot and all the soil removed when the shoots are 1 to 2 inches long. Place in the same-sized pot, say a 6 or 7-inch. Rub off the weakest shoot when free growth commences. Place a stake to each vine and secure the cane to it. Shift into a 9-inch pot immediately the fresh soil is well occupied with roots, and from this into an 11 or 12-inch pot. These sizes are quite large enough for the vines to fruit in. This last shift should be given early in June, never later than midsummer. The potting should be compact, and the drainage thorough, say an inch in depth of good-sized crocks and another inch of smaller, all clean.

Compost.—Three parts of fibrous loam rather strong and gritty, half a part of old mortar rubbish, and half a part of horse-droppings. Use the loam rather rough. Add to each bushel of the compost a quart of steamed bone-meal and 2 quarts of wood ashes. Mix thoroughly, and use moderately moist at the same temperature as the house in which the vines are growing.

Position.—Place the vines at the sides of a low pit or house, the pots as near the base of the roof as is practicable, and train the canes to a trellis about a foot from the glass. If this is inconvenient, and the vines must be grown upright from the stage or floor to the roof, allow such distance between them as to expose every leaf down to the base to the sun's influence. By the first plan fruiting-buds are formed the entire length of the cane; by the vertical training, the upper buds are strengthened at the expense of the lower ones.

Temperature.—Bottom heat after the vines are placed in 5-inch pots is not necessary, especially for cut-backs. Artificial temperature, 65° at night, 70° to 75° by day; sun heat, 80° to 85° (shaded thermometer), rising to 90° or 95° after closing.

Ventilation.—Admit a little air at 70°, allow a free circulation over 75°, yet do not lower the temperature from sun heat through the day below 80°. When the growth is complete, admit air freely day and night. If the vines do not ripen kindly, keep the house rather warm by day and open the ventilators fully at night.

Watering and Moisture.—Never allow the foliage to flag through lack of water at the roots. Let the soil be sufficiently dry to take water freely before supplying any, then

give enough to pass quite through to the drainage. Avoid extremes either way, sodden soil being worse than a rather dry medium. Liquid manure is only necessary after the pots become fully occupied with roots, and should not be given when the soil is dry. Syringe the vines occasionally to free them from dust, and in the afternoon if there are signs of red spider. Damping the house in the morning, at closing time, and in the evening is the best method of providing a moist atmosphere.

Training.—Secure the canes loosely to stakes or the trellis as they advance. Stop the laterals and sub-laterals to one leaf. Remove tendrils. Stop the leader at 6 to 8 or 9 feet, according to the vigour and length of cane required. For treatment of laterals see Fig. 86, A, page 277.

Ripening the Growths.—When the canes are becoming brown and the buds prominent in August less water should be given and more air, but the leaves must not flag through want of water. When the wood is thoroughly firm and brown, and the leaves advanced towards maturity, place the vines outdoors, standing the pots on a board or slates at the foot of a south wall or fence, and secure the canes to the surface. Supply water only to prevent the leaves becoming limp, and place waterproof material over the pots in wet weather. Cut away the laterals to one joint, and in the course of a few days prune them close to the cane, but without injuring the main leaves. When the leaves fall, shorten the cane to the first plump bud below the stopping, or to the length required, dress all cuts with best painter's knotting, and place the vines in a cool house from which frost is barely excluded. This treatment applies to vines intended for early forcing, and they should be pruned and rested six weeks at least before they are placed in heat. The later vines may be continued under glass with abundance of air, only giving sufficient water to keep the foliage healthy, and when the leaves show signs of maturing, shorten the laterals gradually, and in the course of a week after the leaves fall shorten the canes to plump unstarted buds. These vines need not be stood outdoors. They will be eligible for starting early in December to supply ripe grapes in April. Some growers place the vines outdoors to harden the wood, and protect the pots with dry material. They are better placed under cover before the setting-in of severe weather.

When vines are not required for early forcing, large and strong canes are produced from "cut-backs" by shifting them a time or two more, say into 13 or 14-inch pots, or even larger. Such vines ripen the canes in autumn, and afford fine fruit the following year, while if not over-cropped, they may be fruited for several years. Mr. Rivers grows excellent vines and crops by placing the pots on hot-water pipes. Good grapes may also

be had from vines in large pots grown in unheated or moderately heated structures, for it is only a question of variety, management, and feeding.

Early Forcing with Bottom Heat.—A low three-quarter span-roofed house, about 8 feet 3 inches wide, is the best for very early forcing. It must face due south. Span-roofed houses should have the ends east and west. The north slope of the roof answers for black grapes, but white varieties must have the south side. All very early-forced vines do best with bottom heat. An admirable plan of securing early grapes is to plant the cut-back vines out (instead of transferring them to the fruiting pots), 2 to 2½ inches

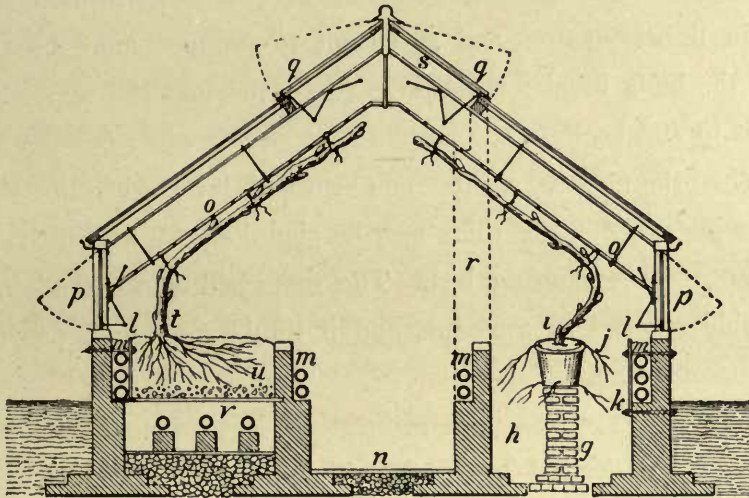


Fig. 97. SPAN-ROOFED PIT FOR EARLY-FORCING POT VINES. (Section through L2, Ground Plan, Vol. I., page 71.)
(Scale: ¼ inch = 1 foot.)

References:—*g*, 9-inch loose brick pedestal; *h*, pit for fermenting material; *i*, vine stood on pedestal; *j*, roots after the vine is in growth encouraged over the pots' rims; *k*, roots from base of pot; *l*, slate slab on edge; *m*, hot-water pipes; *n*, path; *o*, trellis; *p*, side lights; *q*, top lights. Planted-out in span-roofed house, or three-quarter span-roofed pit: *r*, back wall in dotted outline of three-quarter span roof; *s*, fixed back light of the span roof; *t*, planted-out vine; *u*, bed; *v*, chamber with hot-water pipes.

apart in a prepared bed, about 1 foot deep, with 3 inches of rather rough old mortar rubbish for drainage, resting on the open-jointed covers of a hot-water chamber. In that way the vines are as well under control as if they were in pots, make better canes, and start promptly when wanted.

There is more art in preparing the vines for early forcing than in forcing them, for most failures are due to ill-formed buds, badly ripened wood poorly stored with assimilated matter, and insufficient healthy fibrous roots. It is of no use whatever attempting to convert manifest failures (poor canes) into successes, nor to force the best canes without command of a light, well-ventilated, and properly heated structure. A span-

roof house providing those necessities of very early forcing, with provision for bottom heat by means of a fermenting bed, is shown in Fig. 97, opposite.

To have ripe grapes in March the vines must be in position by the middle of October, and forcing must be commenced the first week in November; in April by the middle of November and started the first day of December; in May by the middle of December, and forcing heat given on New Year's Day forward. The pots may be stood on slates on the hot-water pipes, but brick pedestals are the best; the pit may be filled with three parts oak, Spanish chestnut, or beech leaves, and one part stable manure, thrown into a heap, moistened, and turned once or twice to warm and sweeten. This should be put in lightly at first, and so as not to produce more heat about the pots than 65° until the buds break; then press down the material and add more, so as to increase the heat to 70° , keeping the bottom heat steady when the vines are in leaf at 70° to 75° . When the material has become firm and level with the rims of the pots, turves 6 inches wide and 2 inches thick may be placed on the soil in the pot, and extend over the rim on to the fermenting bed. The roots will then extend into the bed, and afford considerable support to the vine, and if liquid manure is poured on the turves the grapes will become fine.

Place the vines 2 feet apart—more rather than less—depress the canes so that the lowest buds which are desired to break will be the most elevated, and secure the vines to the trellis when an even break has been effected. If portable vines are wanted for decorative purposes when the fruit is ripe, coil each cane round three or four stakes placed in the pot so as to form a column or bush when fully grown, as shown in the engraving, Fig. 98, page 315, or in such other form as may be desired.

The treatment of vines in pots is identical with that of fruiting vines generally. Those forced early and cropped heavily are of no use for future work. They may, therefore, be allowed to carry all the fruit they are able to bring to maturity, but $\frac{3}{4}$ pound per foot of rod is as much as can be expected, and 1 pound per foot of rod is a maximum crop when the roots have the run of a fermenting bed. Six to 8 pounds per vine is considered a fair crop; it is an extravagant estimate of the producing capabilities of a vine forced to ripen the fruit in March, yet that weight is much exceeded by vines which ripen their crops in summer. Vines for fruiting in pots must be well grown and the grapes well coloured, otherwise they are unsatisfactory and costly.

To have grapes ripe in March or the beginning of April, forcing, as before stated,

must commence the first week in November, the house in the preceding fortnight having been kept at a temperature of 50° by artificial means, with full ventilation above that heat. Commence with a temperature of 55° at night, and 60° to 65° by day. Increase to 60° at night, and 65° to 70° by day when the buds break, and when the vines are in leaf raise the heat to 65° at night, and 70° to 75° by day, 5° less in severe weather. When nearing the flowering stage gradually increase the heat to 70° at night, and when the grapes are set lower it to 65° on mild and 60° on cold nights, 70° to 75° on mild days, and 65° to 70° when dull and cold, continuing this until the grapes have stoned; then advance the day and night temperature 5°, and continue this until the grapes are ripe. The great point is to get the heat up early in the morning to its day's minimum, and from daybreak to nightfall maintain a genial atmosphere. An increase of 10° to 15° by sun heat is a great aid, but it cannot be relied on during the five worst months of the year. Seek a change of atmosphere daily—if possible, in the early part of the day—by a little top ventilation, but in sharp weather enough air will enter by the laps of the glass and crevices of the woodwork. On fine days ventilate early, and secure a circulation of warm, rather dry air when the grapes are ripening.



Fig. 98. POT VINE COILED ROUND STAKES AND IN FRUIT.

Water must be carefully applied until the buds break, and the soil must not be wet.

Increase the supplies with the growth, and they will need to be liberal as the vines come into leaf and onwards until the crop is perfected. Afford liquid manure after the grapes are set, continuing it periodically till they show colour, and gradually discontinue, say by the time the first berries are fully coloured. Clear water should then be given, but do not sodden the soil by needless soakings. Top-dress with lumpy root-accelerating, growth-sustaining material, and remember that all food supplied must be in a soluble state, such as dissolved bones and nitrate of potash. Slow-decomposing substances, such as $\frac{1}{2}$ -inch bones, are of very little use for fruiting vines in pots.

Atmospheric moisture must be regulated according to the weather and the needs

of the vines at their different stages, the fermenting bed and the free moistening of surfaces as they become dry securing a genial atmosphere. The general management of vines in pots is precisely the same as those planted out in vineries.

Vines in Small Pots for Table Decoration.—Attractive vines, with one or two ripe bunches of grapes, may be secured by layering well-ripened canes in 6-inch pots, filled with soil and placed on a shelf, similar to those shown in Fig. 17, *B, o, p*, Vol. I., page 103, training the shoots upright, stopping them at one joint beyond the fruit, pinching the laterals to one leaf above or level with the fruit, removing those from the joints below, but retaining the main leaves. Keep the soil moist, give water copiously as growth advances, and when the grapes are ripe cut the cane through by degrees inside the rim of the pot, and trim the laterals back, leaving the amount of foliage only that is considered desirable. Larger vines may be had by layering a ripe cane into an 8-inch pot, leaving three or more good buds to produce bearing shoots, as shown in Fig. 17, *C*, Vol. I., page 103.

Another plan is to fix 6 or 8 inch pots on iron standards, with rings at the top suitable for supporting the pots where convenient for taking a ripened cane to the extent required, through the pot, and then filling it to within $\frac{1}{2}$ inch of the rim with turfy loam pressed rather firmly and kept moist. As the growth advances water must be supplied copiously. The growths may also be secured to an umbrella-shaped wire trellis fixed in the pot. Thus vines may be had in 6-inch pots, with one or two bunches of ripe grapes, or in 8-inch pots with more growth and fruit. All the buds not wanted to grow are rubbed off, and the cane detached by degrees close to the bottom of the pot when the fruit is thoroughly ripe. Surfaced with *Selaginella denticulata* to grow and droop over the rim of the pot, such miniature vines, with ripe fruit, are effective for table decoration.

KEEPING GRAPES.

Jet-black, thin-skinned grapes turn more or less red when allowed to hang on the vines a few weeks under strong light or powerful sun. Mill Hill Hamburgh, Black Hamburgh, and Madresfield Court lose colour the most and the soonest. Colour also departs rapidly where the foliage is thin; least beneath a good spread of leaves, and on the north side of a span-roofed house. The time that grapes lose colour most is during the summer and early autumn. We have found a double thickness of herring or a single pilchard net, drawn over the roof beneath which ripe grapes were hanging, to

prolong the retention of colour, without any detriment whatever to the foliage and ripening of the wood. The vines must not lack water at the roots, nor the atmosphere become very dry, or the foliage will suffer, and the grapes may shrivel.

Keeping grapes, however, is a term that applies particularly to those for winter use, yet ripe grapes cannot be kept on vines in ground vineries or unheated houses for any length of time in the autumn. Such may be cut with all the wood that can be spared without prejudice to the pruning buds, before the grapes are damaged by wet or cold, otherwise they will not keep sound afterwards. Remove the leaves and laterals, place the lower end of the shoot in a bottle filled with clear rain-water, which has been secured in an inclined position, so that the bunch will hang clear, in a cool, but frost-proof, rather dry cupboard or room, and the grapes may be kept till Christmas. It is better to cut and bottle grapes than to allow them to remain on the vines after October, when the house is used for wintering plants.

Houses in which grapes are to be kept on the vines must have waterproof roofs, proper heating apparatus, and thorough ventilation. Grapes will not keep well unless thoroughly ripened by the end of September. The longer the leaves can be preserved in health, the sounder the grapes keep after they are gone, provided the fruit is thoroughly ripened, and the wood completely matured. Damp arising through the application of water should be dissipated by efficient ventilation day and night. Grapes cannot keep plump unless the roots of the vines are in a moist, healthy medium. In foggy weather it is best to keep the pipes warm, and expel damp by a chink at the top of the house. Aim at an equable temperature of 40° to 45° after the leaves have fallen, 5° more for Muscat of Alexandria. When frost prevails let the house remain closed; the warmth in the pipes will keep the atmosphere in motion. Look over the grapes occasionally for the removal of decayed berries; indeed, daily after the first are seen. Some growers prefer to keep the grapes on the vines as long as possible. In that case the house is shaded with mats or blinds after the leaves fall, a cool, dry atmosphere maintained, and no more fire-heat employed than is necessary to exclude frost and prevent damp. With great care and attention grapes may be so kept good in quality until March, but there is then great danger of the vines being weakened through bleeding in consequence of the late pruning. The alleged loss of quality in bottled grapes is very slight, and they can be kept much longer off than on the vines. Black Hamburgh grapes are difficult to keep in good condition on the vines till Christmas, but cut when the leaves fell, and placed in bottles, they have kept sound until February. We have

had Lady Downe's grapes plump and full-flavoured on June 7th, when the vines from which they were cut in January were having the current year's crop thinned.

Bottling Grapes.—Although grapes may be kept in a cupboard, a spare dark room, or one end of the fruit room partitioned off, a proper grape room is desirable where large quantities are required to be kept in good condition to a late period. It should have a cool aspect, a dry site, hollow walls, a double roof, double doors, one or more windows, with woollen blinds and shutters, an opening at the apex for ventilation, hot-water pipes to heat it, and be lined with boards tongued together, a space being left between

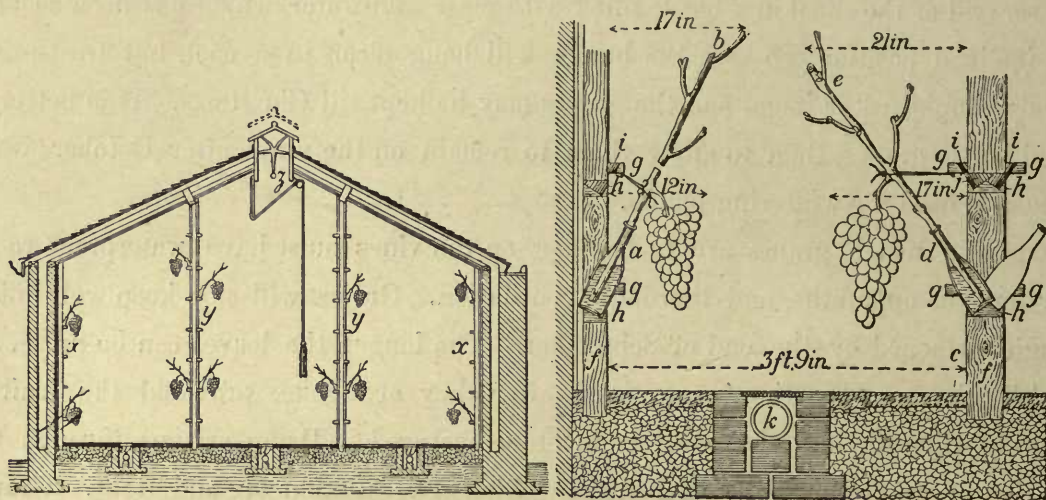


Fig. 99. GRAPE ROOM (left-hand figure) (Section through *W* 1, Ground Plan, Vol. I., page 71) (Scale: $\frac{1}{8}$ inch = 1 foot).

PART SECTION OF GRAPE ROOM (right-hand figure) (Scale: $\frac{1}{2}$ inch = 1 foot).

References:—Left-hand figure: *w*, 4-inch hot-water pipes; *x*, racks against board-lined wall; *y*, upright let into the floor and secured to the purlins; *z*, roof ventilator, with shutter. Right-hand figure: *a*, grapes bottled without wood above the bunch; *b*, with wood; *c*, distance between the rack-stands when bottled without wood above the fruit; *d*, greater projection of grapes when the bottle-rest is fixed level with the under side of the rail; *e*, desirable portion of wood to leave above the fruit; *f*, uprights; *g*, rails; *h*, bottle-rest bars; *i*, scallops; *j*, hole for bottle; *k*, 4-inch hot-water pipes.

the board lining and the wall. The floor may be boarded and raised two steps above the ground level, but a cement or tile floor is preferable for excluding predatory pests. Its construction corresponds with the fruit room, Vol. I., page 204, racks taking the place of shelves.

The side uprights (*x*) should be 3 inches by $2\frac{1}{2}$ inches, fixed narrow face outwards, 3 feet apart; on the face affix rails, $2\frac{1}{2}$ inches by $1\frac{1}{2}$ inch, with scallops cut out on the inside narrow side 1 inch deep, 9 inches apart, to suit the bottles, the first rail 1 foot from the floor, and the other not less than 15 inches apart. Between the uprights, and 1 inch below the under side of the rails, fix a bottle-rest bar, 3 inches by $2\frac{1}{2}$ inches,

with holes of the diameter of the bottles not less than 1 inch deep, and corresponding to the scallops of the rails. The bottle-rests must be level, and flush with the face of the uprights. If wine bottles are used—3 inches in diameter, $8\frac{1}{2}$ inches to the neck, and this $3\frac{3}{4}$ inches long = $12\frac{1}{4}$ inches—and the bottle-rack be prepared as described,

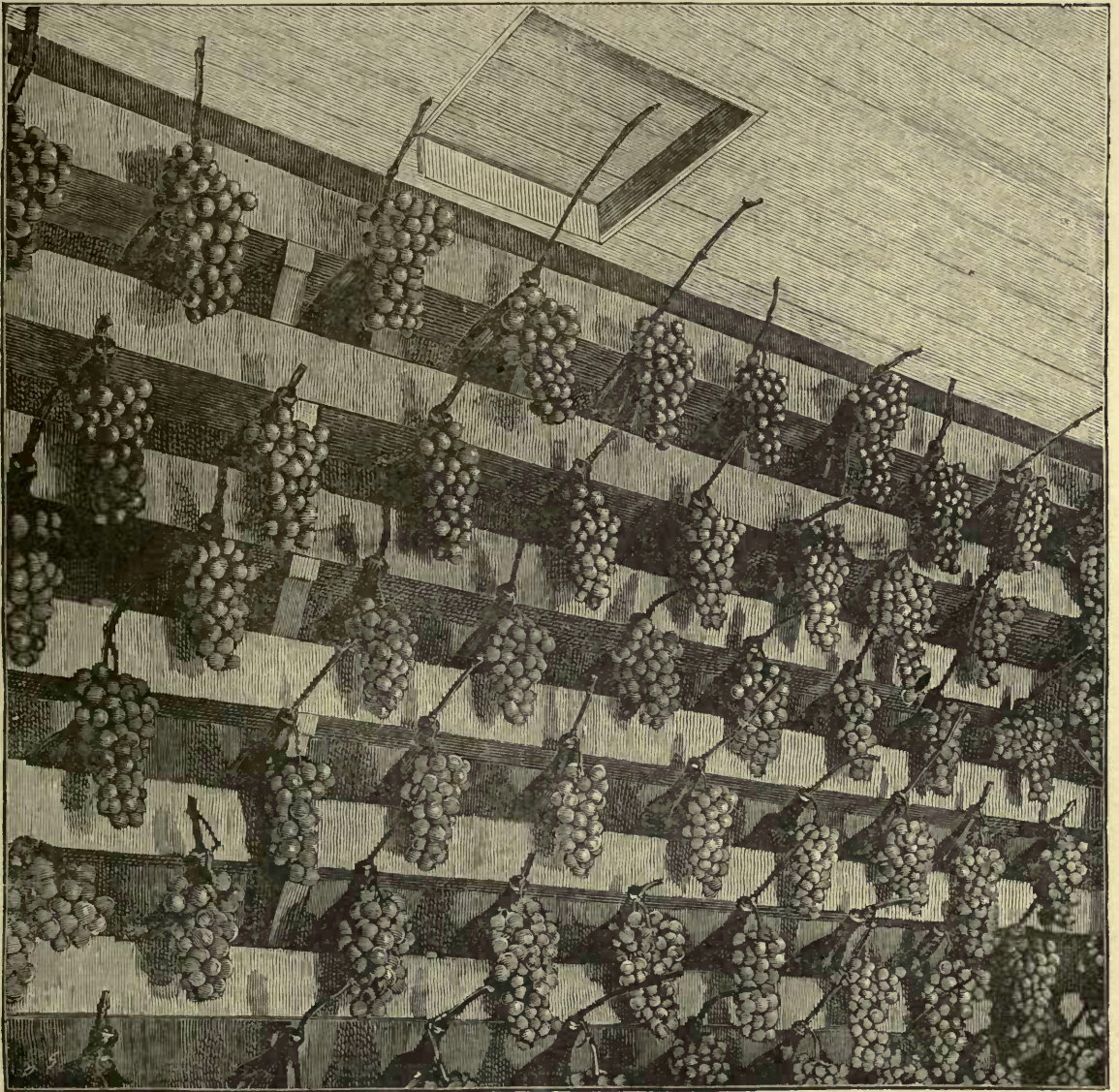


Fig. 100. A PORTION OF THE GRAPE ROOM AT FLOORS CASTLE (From the *Journal of Horticulture*).

the bunch of grapes inserted in the bottle without wood beyond it will project 1 foot from the face of the uprights, as shown at *a* in the right-hand section, Fig. 99; then the distance between the rows of racks may be 3 feet 9 inches (*c*). When the grapes are bottled with wood (*b*) the shoot may project 17 inches; then the distance between the

rows of racks must not be less than 4 feet 6 inches. For the finest late grapes the bottle-rest bar may be fixed on a level with the under side of the rail, so as to let the bottle project more (*d*), and leave not less than two joints of wood and laterals above the bunch (*e*), which occupies 21 inches; therefore, the rows of racks must be 6 feet asunder. The uprights for the detached racks may be $4\frac{1}{2}$ inches by 3 inches, narrow face outwards, with scalloped rails similar to the side racks, but alternate; the bottle-rests should be $4\frac{1}{2}$ inches wide, and flush with the uprights, and holes made on alternate sides to correspond to the scallop.

In Fig. 100 only a small portion of the end of the grape room at Floors Castle is represented. It portrays, however, Mr. Street's method of keeping grapes, of which he observes:—"The plan I adopt is very simple, and I find it answers well, as I always keep the grapes fresh and plump in the berry till the early varieties are ready for cutting, about the middle of May. It will be seen from the illustration that the bottles are fixed in shelves made purposely for keeping grapes. The bottles are filled with clean water, with two or three pieces of charcoal in them to act as a purifier. I always cut plenty of wood with the grapes, say a foot to 18 inches beyond each bunch, and as much as possible from the spur to the bunch, leaving two or three buds to prune to. I think this adds greatly to the keeping of the grapes. With some bunches it is impossible to get the wood long enough to go into the bottle—that is from the spur; in that case I find they keep just as well by inserting the wood from the bunch or lateral end in the water. I make a rule of examining my grapes once a week, filling all the bottles that require water, and cutting-out all bad berries. The grape room is kept dark and cool, never using artificial heat only during damp or very frosty weather. By following that plan I have kept Lady Downe's grapes till June 10 fresh and plump in the berry."

"Several gardeners," states Mr. R. Inglis, "will be found who have a few bunches of grapes hanging, but have no grape room to take them to. It is our practice to cut all that remains after Christmas, and place them at the driest end of the fruit room, where they keep fairly well for six or seven weeks. [We have kept Lady Downe's grapes in an ordinary fruit room till June.] Instead of a proper grape rack, we suspend the bottles from the front of the fruit shelves, as shown in the sketch (Fig. 101, page 321). The bottles are placed about 7 inches apart. Two ordinary carpet-tacks are driven into the front of the shelf, 1 inch apart, for each bottle. A piece of ordinary binding wire is fixed to one tack, a bottle is placed in the desired position, and the wire pulled

tight round the neck and round the other tack ; it is then passed along without cutting it to the next bottle, twisting it round the neck in the same way. The tacks are then driven home, so that the wire does not slip. In a similar manner another wire is fixed so as to form a sort of 'sling' to pass over the bottom end of each bottle, and support it at the desired angle. These should be fixed on the top, and passed down between the openings of the fruit shelves."

For filling the bottles a long-spouted tin can, holding about half a pint, should be used, the spout 18 inches long, and small at the end, so as to be easily inserted in the neck of the bottle without disturbing the grapes. Bottles with clear glass are used, so that the operator can see to a nicety how much water is required, and stop instantly when enough has been poured in to come within an inch of the mouth of the bottle. Ventilation is provided by means of a skylight, across which a shutter can be drawn to darken the room.

All grapes should be cleared off the vine by the middle of January. Black Hamburgs are the first to claim attention, then Muscat of Alexandria. These are best cut as soon as the foliage is ripe, and before much of it has fallen, otherwise the fruit of the first becomes red and the latter brown on the sunny side, greatly marring their appearance. The bottles must be perfectly clean

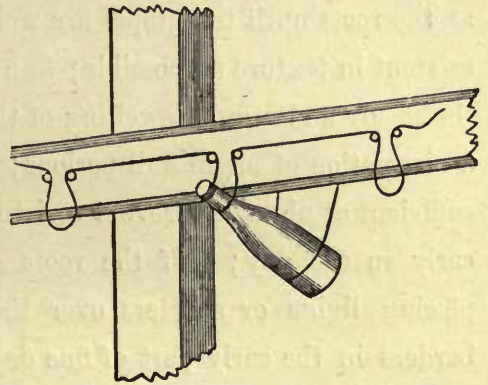


Fig. 101. MR. INGLIS'S METHOD OF SUSPENDING BOTTLES IN A FRUIT ROOM FOR KEEPING GRAPES.

both inside and outside, and filled with clear, soft water. Place them in the racks a few days before the grapes are cut. Two or three pieces of charcoal may be placed in the quart, or one in each pint bottle. This tends to keep the water sweet. Cut the grapes with as much wood below the bunch as can be spared, and shorten the wood beyond the fruit to three or four joints. This shortening is best done when the foliage commences falling, and greatly facilitates the removal of the grapes. Trim off any knobs that will not easily go into the necks of the bottles, and so insert the bunch that it will hang clear of everything. The bunches are best severed from the vines with secateurs, handling carefully, as, if shaken, the grapes suffer in appearance, and may not keep well. One person should cut, trim, and hand each bunch to an assistant, for conveyance to the grape room, one bunch in each hand. It is important to avoid laying the bunches down. In some cases only a little wood can be obtained below the bunch, and it is well to place such together in the room, as they will require water oftener than the others.

The temperature of the grape-room should be kept equable, aiming at 40° to 45°. The best safeguard against damp is to have a little warmth in the pipes, and a circulation of air in mild weather after a severe period; but avoid a very dry atmosphere, which will cause the grapes to shrivel. It is unnecessary to close up the space in the neck of the bottles, for the little moisture arising from the water is not inimical to the keeping of the fruit. Great care, however, must be exercised in filling up the bottles not to spill any water on the fruit, or decay is sure to follow. The bunches should be examined once a week, and any berries that have the smallest speck of decay be promptly removed.

Grapes Cracking.—The cracking or splitting of the berries is most prevalent when the skins are thin and the foliage scanty. The best preventives are:—1, adequate water at the roots until the grapes are well advanced in ripening; 2, a good spread of foliage as stout in texture as possible; 3, a genial condition of the atmosphere so as to ensure the steady and regular swelling of the berries; 4, enough warmth in the pipes to ensure a circulation of air in dull periods; 5, free ventilation by front and top sashes, leaving sufficient at night to prevent moisture being deposited on the berries, and increase it early in the day; 6, if the roots are outside prevent the soil becoming saturated by placing lights or shutters over the border so as to throw off rain; 7, water inside borders in the early part of fine days, admit air freely so as to dissipate the surplus moisture, and mulch with short dry material after the last watering; 8, above all things avoid a close moist atmosphere when the grapes are ripening, or the fruit will split through endosmotic action (see page 25, Vol. I.).

RENOVATING VINES AND VINE BORDERS.

Unsatisfactory and apparently worn-out vines may often be renewed in vigour by the removal of effete soil and the supply of fresh compost. This is the only sure remedy for those ills which result from torpid roots, and the consequent inadequate supply of proper food. Dread of a year's loss of grapes often deters many persons from adopting the means essential to a better supply. There is just reason to apprehend such loss where the roots are in bad condition. To lift vines with a few strong fibreless trunk-roots extending across a border and thus cut away all the fibry portions at their ends, wherever they may be, is simply courting disaster. Instead of lifting such vines, the better practice is to clear away as much of the top-soil about the collars as possible early in the autumn, laying the roots bare and notching them, then supplying fresh

compost including plenty of wood ashes. Fresh roots will then, in most cases, be freely emitted from the collar of each vine as well as along the trunk roots (*a*, *b*), as shown in the illustration, Fig. 102. By that practice vines may be greatly resuscitated without prejudice to the crops, especially if fresh canes are encouraged, cutting out the old rods by degrees.

In many cases, however, the borders may be entirely renewed without loss of crop, especially where the roots occupy inside and outside borders, the inside border being operated on one year and the outside border the next. The best time to perform the work is whilst the leaves are on the vines, say, after the grapes are cut and the wood firm. Early vines may be lifted from the end of July to early in September, according to the

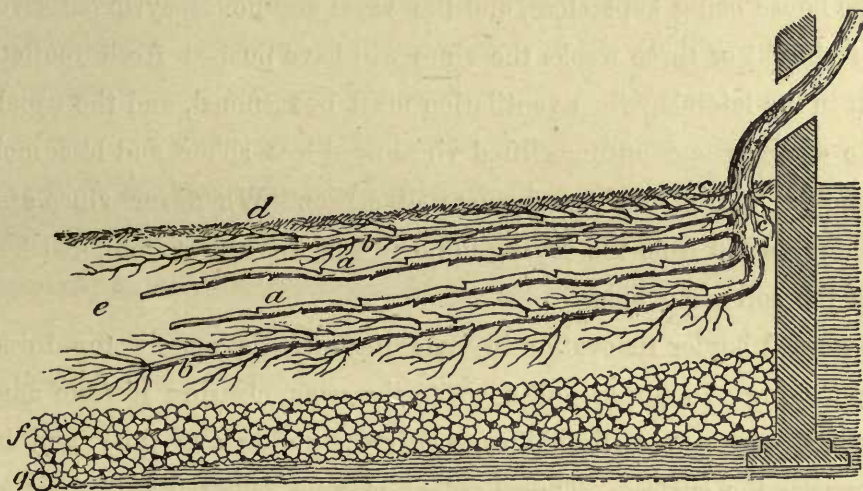


Fig. 102. NOTCHING VINE ROOTS.

References :—*a*, roots notched to cause the emission of fibres ; *b*, result of notching vine roots ; *c*, adventitious roots from the collar ; *d*, mulching ; *e*, border ; *f*, drainage ; *g*, drain.

time the grapes ripened ; midseason vines at the close of September or early in October ; late vines cannot be interfered with till their crops are cleared. Properly prepared fresh soil with, if the drainage needs renewal, clean rubble should be provided and placed handy, so as to facilitate the work, and upon its careful dispatch success in a great measure depends.

Commence by removing the old soil at the point furthest from the stem, work towards it, and lay the roots aside as they are cleared, covering them with damp mats. Take particular care of the smaller roots near the stem, breaking none by tying back, nor injuring any by rough usage. Make sure that the drainage is perfect ; if not, put in new. Make the border up in the best manner to half its depth, then proceed to lay

in the roots in the upper half of the border, and in layers straight and even, working the soil into the angles, and make it moderately firm. Any long bare roots may be shortened, but a vine cannot have too many roots, and all that are available for laying in the top half of the border should be preserved. Some cultivators clear away one-third, and in some cases half, the width of the old border without any regard to the roots, and only re-make the border about a foot wider than the shortened roots extend. This answers well when the vines are fairly well furnished with roots near the stem, the remainder of the border being added as more root space is required.

If the soil is moist, water need not be given, otherwise afford a thorough supply. With the vines in leaf, shading must be continued until the foliage is able to bear exposure, the house being kept close, and the vines and house syringed several times a day. In a fortnight or three weeks the vines will have pushed fresh rootlets and show it by growth in the laterals, when ventilation must be resumed, and the usual treatment given. Late summer and autumn lifted vines need less shade and less moisture, but the foliage should be kept fresh, to favour root action. Whenever vines are lifted the roots must be protected from the drying influences of the atmosphere, and kept as short a time out of the soil as possible.

What is termed border renovation in some instances is merely top-dressing. This consists in removing the surface soil down to the roots, clearing it from amongst them carefully, raising such as are eligible, especially the young and fibry, and laying them in fresh loam near the surface. Thus borders may be renewed half their depth with great benefit to the vines, provided the draining is efficient, the new soil duly watered, and liberal top-dressings applied.

Aërial Roots.—These are adventitious roots produced on the stems, rods, and spurs of vines. They afford evidence that the atmospheric conditions are more favourable to root production than are those of the soil. Yet, keeping the house close, moist, and warm will induce stem roots on perfectly healthy vines with the ground roots in the best of borders. Aërial roots often signify too rapid forcing, excessive atmospheric moisture, and deficient ventilation. To prevent their formation in such cases is a simple question of management, namely, less forcing heat, less frequent damping of the canes, less atmospheric moisture, and more air.

But roots on the stems are frequently the consequence of those in the earth being in a cold outside border, and it is important that the roots of early forced vines be established in a congenial inside border. Reciprocal activity between the roots and branches

is the best preventive of aërial roots. If the border has become a close inert mass take it away and supply fresh soil, for vines that have healthy roots and are not overdone with moisture and warmth in the early stages of growth emit few or no aërial roots. These, where the vines do not receive adequate supplies of nourishment through the proper channels, are more beneficial than otherwise, and may remain to wither and die.

GRAPE VINE DISEASES.

There are only four fungous diseases of the grape vine in this country which occasion sufficient damage to warrant attention:—mildew, shanking, spot, and root-rot.

Mildew.—This is the name given to the whitish coating which covers the shoots, leaves, and fruit, either in patches or extended over large portions, and is caused by more than one fungus. The most common and best-known is *Oidium Tuckeri*, so called after Mr. Tucker, gardener to Mr. J. Slater, of Margate, in whose vinery it was first noticed by the Rev. M. J. Berkeley, in 1831, and described by him in 1847, when it was generally known. In 1848 it was noticed in France, in 1851 it had spread to most vineyards in Europe, and in 1852 it was found in Madeira. It had been known to exist many years previously in America, and, now that it has been proved, as Mr. Berkeley suggested, to belong to *Erysiphe communis*—a more fully developed form—it may be considered a native of this country.

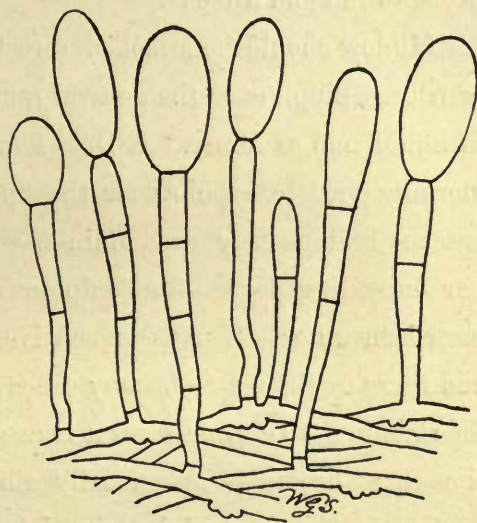


Fig. 103. *OIDIUM TUCKERI* (GREATLY MAGNIFIED).

The *Oidium* first appears as a mere speck, and spreads with amazing rapidity. The diseased parts become pale and more or less distorted, then brown. When examined with the microscope, the surface of the attacked part is shown to be covered with the mycelium (filaments) of the fungus, and from the side of each little suckers push into the skin (epiderm) cells, and these absorb food from them for the parasite. On the other side of the mycelial threads spring little branches, each formed of a row of cells, of which those at the ends of the branches (conidia) are oval, and break away to produce the *Oidium* again when they fall on suitable vine-growths. The fungus as it appears under the microscope is represented in the engraving, Fig. 103. The mildew proves

very disastrous, even when its growth is arrested or destroyed, the epidermal tissues being so impaired by the attack as not to recover, the parts are blackened, and growth ceases, affected berries often splitting, and the crop is more or less ruined.

The cause of Oïdium is its reproductive bodies falling on and finding suitable positions on vine leaves, shoots, and fruit, with certain atmospheric conditions favourable to its development. Cold, damp, low situations, and a stagnant atmosphere indoors aid infestation. But both outdoors and indoors it spreads rapidly in a moist, warm atmosphere. It is greatly checked outdoors by rain, and indoors by dry air. Plenty of air, so as to secure thoroughly solidified growths and thick leaves, is the best preventive of Oïdium. Dry soil should also be avoided, for vines that are dry at the roots are prone to fungoid attacks.

Mildew should be attacked directly small mealy spots appear on the leaves, shoots, or fruit. Sulphur is the general remedy. It is applied in three ways, namely, dusting, in liquid, and as fumes. 1, Dust flowers of sulphur all over the vines, choosing the early morning or late evening for the operation, and the sulphur will rest on the fungal patches and destroy the Oïdium. In the course of a few days—not less than two, nor exceeding seven—the sulphur should be washed off by forcible syringings with clear rain-water. This is imperative, because the grapes are not otherwise fit for table, and there ought not to be any trace of sulphur on the berries when they change colour for ripening. In some cases it is necessary to repeat the application, but when taken in time first dressings are usually efficacious. 2, Bisulphide of calcium, prepared and applied in the way advised in Vol. I., page 248, effectually extirpates mildew. The danger of staining the fruit is a serious objection to the employment of liquid compositions, especially those containing soapy matter, and they are best avoided. 3, Highly heat the hot-water pipes in the afternoon while the ventilators are open, wipe a wet rag along a couple of yards of piping at a time, and dust with flowers of sulphur from a piece of muslin while the pipes are wet. A thin coat of sulphur on the top side of the pipes is sufficient. In the evening, after the sun heat is mostly gone, and the pipes have been made as hot as possible without causing the water to boil, the house should be closed, when the fumes from the sulphur will fill it, and in an hour (two, if a large house) every particle of mildew will be destroyed. The heat in the pipes should then fall to that ordinarily required, and in forty-eight hours the sulphur should be removed from them. Some slight portions, however, may remain, and will act as a preventive of further attacks. The sulphur may be mixed with skim-milk, and applied with a brush

thinly to the upper half of the surface of the pipes. The fumes of sulphur are always attended with risk of rust when the berries are the size of peas or less, and an overdose may so harden the skin as to cause the berries to crack or to colour prematurely, whilst nearly ripe or quite ripe white, tender-skinned grapes become tinged with purple hues and spoiled. Sulphur on hot-water pipes must be used carefully and discriminately. Placing lumps of fresh-burned lime in flower-pots, sprinkling with water and scattering sulphur upon the hot, slaking lime is often as injurious to the vines as destructive of the mildew or other parasites, and the practice is best avoided.

Other forms of mildew occasionally attack vines. One of these is the Strawberry Blight or mildew, *Oidium Balsami*, which somewhat resembles *O. Tuckeri*, but its conidia are more slender, and the attacks more local. It infests the stems of the bunches and footstalks of the berries, distorts them, and depreciates the value of the grapes. The *Oidium* succumbs to early and persistent treatment with flowers of sulphur.

As preventive of parasitic fungi, all dead leaves and prunings should be collected and burned, the surface soil removed, and fresh compost supplied; the glass, wood, and iron thoroughly cleansed, the structure painted, walls limewashed, the vines washed with soapy water, and dressed with a fungicide.

Of late years a disease has attacked the half-grown leaves of young vines and the laterals of old ones in August and early September. It commences at the points of the shoots, causes the leaves to contract, the whole tissue hardens and becomes leather-like, assumes a blackish-brown appearance, growth entirely ceases, and shrinkage occurs in the young shoots. The disease resembles a bad case of rust, and is common to cucumbers and tomatoes late in the season. We have not been able to detect any parasite. The affected parts should be cut off and burned.

Shanking.—This malady causes the withering of the footstalks of the berries and sometimes the stems of the bunches. It generally appears when the grapes show colour, and continues till they are ripe, sometimes afterwards. In bad cases shanking commences before the grapes begin colouring. A few berries here and there are found in the bunches of the best-managed vines; in the worst cases whole branchlets and even entire bunches collapse. Shankered berries are sour and worthless.

The disease may be traced from a minute brown speck to its final encirclement of the stalk of the berry, or stem of the branchlet or bunch. Sometimes the ring is very narrow, as if formed by the finest wire ligature, in others it is more irregular and broader, and in some cases the whole footstalk or stem is discoloured. The gangrene

does not always encircle the footstalk or stem; then the part affected does not collapse at the time, but it may occur later, as is seen in bunches which are kept some time after being ripe. This may be termed the dry gangrene, and attacks almost every kind of grape, but the other form is the most disastrous, and ruins many crops of grapes.

All grapes are liable to this disease. Outdoor grapes, because they are the hardiest, suffer the least, and are less subject to errors of management. Frontignans are most attacked, because they are the tenderest. Early forced grapes are less liable to the disease, because they are seldom over-burdened, than midseason and late grapes, which are often cropped within "an inch of their lives."

The most prevalent conditions of soil, plant, and management culminating in shanking are: 1, Wet and cold subsoil, soil sour and soddened. 2, Borders formed of over-rich material, an excess of organic matter, soapy in staple, containing spongy roots. 3, Too open staple, lack of moisture for the roots. 4, Excessive feeding, too strong liquid manure from tanks, and too heavy mulchings. 5, Chills and checks caused by applications of cold water or liquid manure, and sudden and extreme changes of temperature. 6, Irrational manipulation of the growths, neglecting to disbud and stop the shoots until it becomes necessary to remove large quantities. 7, Over-crowding the foliage so that by lack of air and light it cannot perform its proper functions. 8, Imperfect ventilation, which causes the leaves to be thin in texture, weak in elaborative power, and easily scorched. 9, Foliage impaired by attacks of red spider. 10, Excessive atmospheric moisture. 11, Deficient foliage and lack of lateral extension. 12, Over-cropping, allowing more fruit to remain than the vines can support, and hence the collapse and calamity.

These are some of the inducements of shanking, a disease caused by bacterial and fungal germs finding a fitting nidus for their development. The way to prevent shanking is to avoid everything calculated to debilitate the vines. Strengthen the weakly varieties, such as the Frontignans and Black Muscat, by working them on others with constitutional hardiness, such as Foster's Seedling, and follow the instructions which have been given for the production and sustenance of active roots and healthy foliage. Affected berries should be cut out and burned, and measures taken to prevent the recurrence of the evil by correcting the defects of soil, feeding, and management. Judicious applications of superphosphate of lime, sulphate of iron, and gypsum fortify vines:—say, superphosphate, $3\frac{1}{2}$ pounds; sulphate of iron, $\frac{1}{2}$ pound; gypsum, 1 pound; mix and apply at the rate of 5 ounces per square yard when the vines are coming into

leaf, and again when the grapes are thinned. Lime, calcined oyster-shells, Thomas's phosphate, and coprolites are good applications to vine borders which are not mechanically wrong in texture, and a good dressing of a calcareous ferruginous gravel, mixed with the soil as deeply as the roots admit, is good for borders that are too close in texture.

Spot.—There are two affections of the berries of grapes which are termed spot. 1, Muscat of Alexandria and Canon Hall Muscat are subject to a small, uneven, whitish spot on the berries while young, tender, and swelling quickly. On the depressed patches a series of minute dots shortly afterwards appears, and under the microscope they prove to be a fungus, *Glæosporium læticolor*, which grows outwards, and its mycelial threads traverse the interior of the fruit. The occurrence of this form of spot is attributable to sudden chills, such as admitting air too freely and too late on a sunny morning, or after a period of sunless weather, during which the house has been kept very close and moist. The preventive, therefore, is careful attention to the ventilation (see "Scorching").

2. Spot also appears on ripening or ripe Muscat of Alexandria, Duke of Buccleuch, and other grapes with skins highly susceptible of injury by damp. Brown spots appear on the berries, and spread rapidly. This disease is very disastrous, often causing serious loss of fruit in a short time. It also is associated with, if not caused by, *Glæosporium læticolor* in the half-ripe fruit, whilst that of the ripe fruit is probably *Glæosporium fructigenum*. There is no remedy, but it is advisable to remove and burn all affected fruits; the best preventive is a free

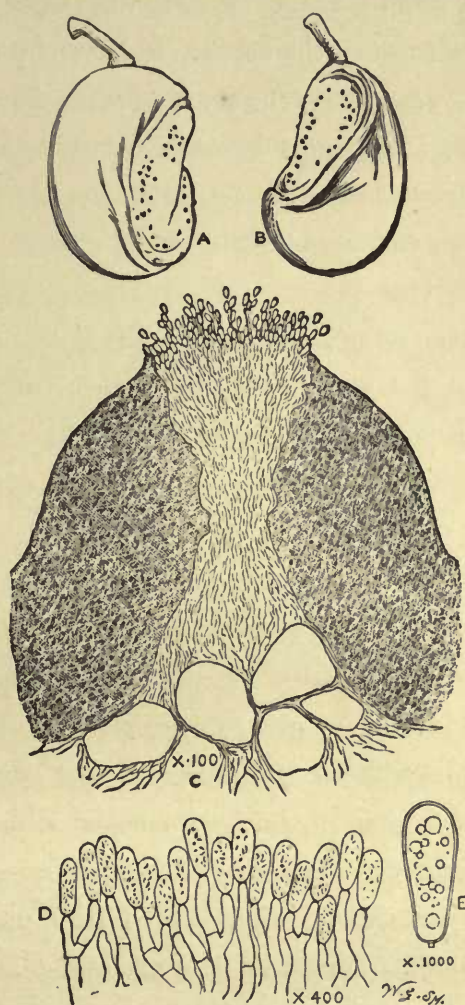


Fig. 104. FUNGUS PRODUCING SPOT ON GRAPES. (From the *Gardeners' Chronicle*, Vol. VIII., third series, page 657.)

References.—A and B, first appearance of spot in grapes—small whitish bruise-like patches, from which the pulp beneath at length recedes or contracts, and a depression more or less extensive forms on the side of the berry, as shown. C, five transparent cells of the grape pulp at the base; skin of the grape on the right and left, with orifice formed in the thick skin; and fungus threads bearing an abundance of spores. D, tops of spore-capped threads enlarged 400 diameters. E, single spore, enlarged 1,000 diameters.

circulation of air, and a gentle warmth in the hot-water pipes with a little air constantly in damp periods. Roof-heating is singularly efficacious in preventing the deposition of moisture on the berries, and thereby averting the disease.

Root-rot.—The roots of vines have been found destroyed by four or more different fungi, the most common being *Agaricus melleus* and *Dermatophora necatrix*. These parasites usually begin with and kill the younger roots, causing the leaves of the vine to turn yellow and fall off, and, after lingering some time, perhaps years, in a sickly state, the vines perish. There is no remedy, except in the immediate removal of the attacked parts, clearing away the soil, and supplying fresh, free from fragments of wood. Badly infested vines should be removed and burned. In forming or renovating vine borders scrupulous care should be taken to exclude beech mast, twigs, or branches of trees, also bits of wood, such as are found in old plaster, for these foster fungi, which may spread to the roots of the vines, and cause them, when coming in to profit, to droop and die.

GRAPE VINE INSECTS.

Mealy Bug (*Coccus* (*Dactylopius*) *adonidum*).—This pest is the most loathsome to which the vine is subject, for the insect not only clothes itself with cottony tufts of a white substance, but secretes a sticky fluid, rendering the berries offensive. The male insect is small, pale red, covered with a white bloom, and has white wings, spotted with red on the front margin, and the horns (antennæ) moderately long. The female is much larger, oblong, wingless, reddish, but covered with white meal or powder, and possesses a beak. Until the time of laying her eggs she moves freely, then remains over the cottony substance. The eggs soon hatch, and the insects spread from stem to branch, leaf, and fruit. The female hibernates in winter in cracks of the woodwork of the house, and beneath rough bark, and this renders the insects rather difficult to eradicate. The utmost care, therefore, should be taken not to introduce this great vine pest with plants.

The mealy bug makes its appearance when the vines start into growth, and should then be vigorously combated. The vines should be closely examined at least once a week, and wherever a trace of cottony matter is seen apply spirit of wine with a small brush. By all means keep the insects from the bunches. If they get there, touch each with the smallest possible quantity of spirit of wine (35 per cent.). Then, when the grapes are cut, remove all the laterals, shorten the bearing wood to about three joints above the pruning buds, and burn all the trimmings. The pests will not have

hibernated, provided this is done whilst the leaves are green, and they are then easily assailable with a petroleum mixture (Vol. I., page 261), or the following:—water, 4 gallons; petroleum, $\frac{1}{3}$ gill. This should be used by alternate squirts into the vessel and over the vines. The work must be done so as to wet the vines thoroughly in every part, also the woodwork and walls. Repeat in the course of three or four days, but before doing so cover the border with any available material to keep the petroleum from the

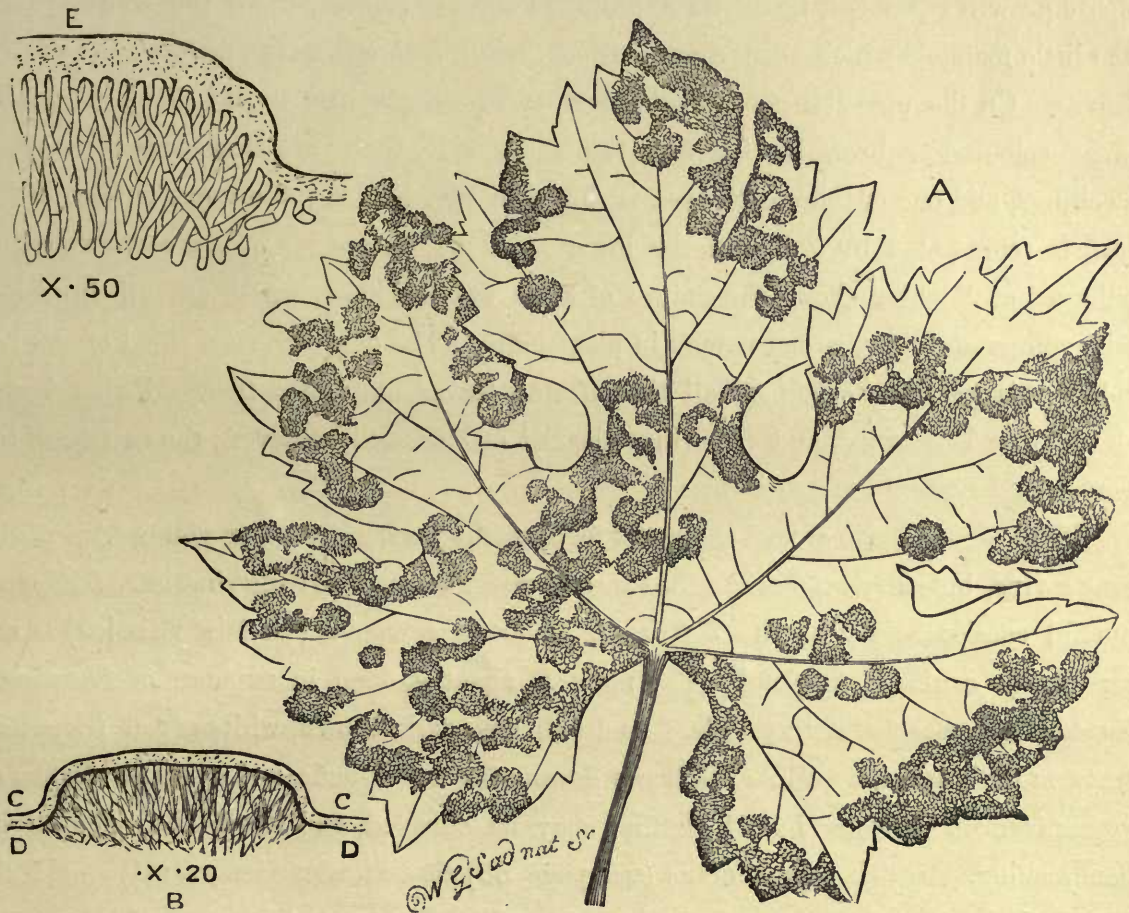


Fig. 105. DISEASE OF VINES CAUSED BY THE VINE MITE, PHYTIOPTUS VITIS.

roots. Follow in a week with another syringing, and a third at a similar interval. This treatment is usually sufficient to extirpate mealy bug, together with cleansing and painting the house, limewashing the walls, dressing the vines with an insecticide, removing the loose surface soil, and applying a top-dressing of fresh soil. If the leaves just before falling are infested with mealy bug, gather them from the vines, and burn them instead of allowing them to shrivel and fall in the house.

Mite (Phytioptus vitis).—This arachnoid exists under four forms: first, as a very

small larva with two pairs of legs, and lies hidden in the little felted nests of hairs on the under side of vine leaves, as represented in the engraving, Fig. 105, *A*, page 331, and in these it deposits eggs. In the second form it becomes six-legged, and passes the winter amongst the nest hairs in dead leaves. In the spring the six-legged insect gets another pair of legs, ascends the vines and selects the lower surface of the young leaves, which it pierces, and there deposits its eggs. On each affected spot a dense growth of swollen leaf-hairs appears, forming a protection for the true eggs and the little maggots which soon emerge from them. The effect is to distort and ruin the leaves. On the upper surface of the leaf, and corresponding to the felted masses of cream-coloured or brownish hairs on the under side, there are numerous large green swellings, and one of these cut across is shown in Fig. 105, *B*; the upper surface of the leaf is represented by *C C*, and the lower at *D D*. A portion of the section farther enlarged at *E* better shows the nature of these swollen hairs, which are all furnished with numerous joints, as is common in plant hairs. The only known method of getting rid of this pest is to pick off all the affected leaves and burn them. Fallen leaves should also be burned, and the vines cleaned and dressed, removing the surface of the border, and supplying fresh compost.

Moths.—The larvæ of various moths feed on the leaves, twigs, or young fruit of the grape vine, but they are seldom the cause of much harm in British vineries. The most hurtful species belong to the Tortricina. *Lobesia reliquana* (*Tortrix vitisaina*) is not rare in the south of England. The moth is about $\frac{7}{16}$ inch in expanse of forewings, chestnut red, marbled with pale buff, and with two dark brown, white-edged triangular spots on the margin of each. The larvæ devour the flower-buds, and spin the clusters of young fruit up in webs, by which they may be detected, and should be removed by handpicking. *Tortrix angustiorana* (see page 88) also attacks vine growths and fruit. The moth, larva, and pupa are figured on page 89. The larvæ feed on vine leaves, and may occasionally be found on ripe grapes, fastening them together by a web. Other species of *Tortrix* feed on the flower-buds and on the young grapes, but have done little injury in this country. The change to the pupæ state occurs in the soil in some cases, and the larvæ of some of the Tortricina pass the winter under the loose bark on the stems, whilst the pupæ of some are similarly protected. It is desirable to remove all loose bark and dress the vines in winter with an insecticide applied with a stiff brush, clear away all dead leaves and the loose surface soil, and supply a good top-dressing afterwards.

Vine Louse (*Phylloxera vastatrix*).—This pest forms galls on both roots and leaves of varieties of the European vine (*Vitis vinifera*), and, if unmolested, soon destroys attacked vines. The leaf injuries are trifling as compared with those inflicted on the roots, to the young rootlets of which the insects affix themselves and push their suckers (probosces) through the bark. New cells are formed—galls of varied size being developed, some as large as a pea. These galls die, and the roots also, so that the vines are starved, also further weakened by the insects abstracting food from the older roots and leaves. The insect passes the winter on the roots. The effect is to ruin the vines in two or three years, but the insects leave the vines for “fresh pastures” before

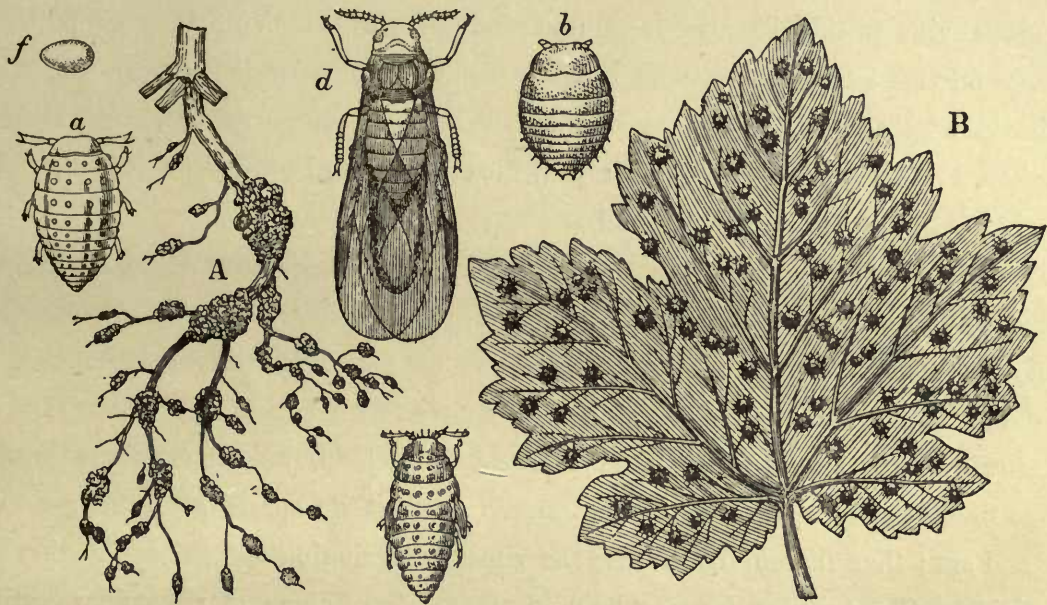


Fig. 106. VINE LOUSE—ATTACKS ON ROOT AND LEAF.

References:—*A*, portion of vine-roots, showing swellings and galls; *a*, hibernating larva (root form); *b*, larva (leaf form); *c*, wingless female; *d*, winged female; *f*, egg: this and insect forms greatly magnified. *B*, appearance of attacks on leaf.

their hosts are quite dead. The eggs are laid in autumn between the crevices of the bark of the roots, and the larvæ emerge in spring and pass into mature females with little alteration beyond enlargement. The larvæ generally attack the leaves, forming small reddish warts on one surface of the leaf and a small depression on the other, a slit, closed with hairs, forming the entrance to the gall. Wingless insects emerge from the leaf-galls, form new galls, and ultimately pass down to the roots.

The remedial means of destroying *Phylloxera* are various, and the most successful for this country is to remove the vines and soil, thoroughly cleanse the house, then plant vines free from nodosities at the extremities of the fibres, and in entirely new borders.

Thoroughly saturating and keeping the soil soaked with water for about six weeks has proved effectual. The insect seems to be most troublesome in warm and dry soils, being confined to inside borders kept too dry; at least, it has not been found to infest vines in moist or outside borders. Bi-sulphide of carbon applied to the roots also destroys the pest without injury to the vines, especially when applied in winter. The American vines, *Vitis cordifolia* and *V. æstivalis*, have been largely used on the Continent as stocks on which to graft varieties of *V. vinifera*, with good results in resisting the attacks of the vine louse.

Red Spider (*Tetranychus telarius*).—This most troublesome and injurious insect to the grape vine in this country is figured and described in Vol. I., page 269. Its presence on vine leaves is indicated by their assuming a brownish appearance, caused by the insect abstracting the juices, and, unless prompt measures for their extirpation are taken, the foliage is speedily destroyed, the current crop injured or ruined, and the following season's prospects prejudiced.

To prevent attacks of red spider, the house should be thoroughly cleansed, the vines washed and dressed, the border freed of the loose surface soil and a top-dressing given directly the vines are pruned. The roots must not lack water nor nourishment, and the atmosphere should be maintained in a moist genial condition whilst the vines are growing, with proper attention to the ventilation. If an attack occur promptly sponge the infested leaves, and by that means prevent its spread until the grapes are ripe and cut; then thoroughly cleanse the vines by syringing and the application of an insecticide. Clear rain-water may be used to free the foliage of red spider until the grapes change colour. The hot-water pipes may be sulphured as described under "Mildew," page 326, and the remedies given in Vol. I., page 269-272, be used according to the exigencies. Remember that draught and poverty at the roots and in the atmosphere foster these mites.

Scale (*Lecanium* (*Coccus*) *vitis*).—The male insect is very small, brick red, thorax black, horns (antennæ) brown, with two transparent wings which have a thickened red border in front, and the body terminates in two long bristles. The female is altogether different. It is covered with a reddish-brown scale, with black dots, oval and convex, and this shield is bordered by a white cottony substance in which the eggs are laid. This plague can only exist where the vines are not properly attended to in winter dressings, as it lives on the stems, and may spread to the leaves and fruit. It is not a native of this country. Similar remarks apply to the vine mussel scale (*Mytilapsis*

vitis), which lives on the previous year's wood and closely resembles apple mussel scale (see Vol. I., page 273). The rods and stems should be freed of the insects with a stiff brush and a strong potash solution, say wood ashes steeped a few days in double the quantity of water, then strain off the liquid. The soda and potash solution, Vol. I., page 251, may also be employed.

Thrips (*Heliothrips hæmorrhoidalis*).—This is the most common species found on vines, but the yellow thrips occasionally infest the foliage and ripe fruit (see Vol. I., pages 274-276). Fumigation is the best remedy, taking care to deliver the smoke cool, to have the foliage dry, and not to give an overdose. Thrips are generally introduced to vines by infested plants, and the insects are favoured by a dry atmosphere. Washing the leaves with a soft-soap solution, 2 ounces to a gallon of water, using a sponge, is a good means of checking the spread of the insects, and early action saves an immense amount of after trouble.

Weevil.—The Black Vine Weevil (*Otiorhynchus sulcatus*) is aided in its depredations by the Pitchy-legged (*O. picipes*), and they do considerable damage to vine leaves and roots. *O. sulcatus* is black or dark brown, with yellowish tufts of hair on the deeply furrowed elytra, the thorax is coarsely tubercled with a slight furrow down the middle, and the beak is deeply grooved. It has six legs with toothed thighs, and is about $\frac{3}{8}$ inch long. The larvæ are dirty white and legless. They feed on the young roots for several weeks, become pupæ in the soil, and the weevils emerge in about a fortnight, and at once commence feeding on the vine leaves.

Larval attacks are most difficult to deal with, but they must be mitigated as far as practicable, otherwise newly planted vines may be seriously injured, if not destroyed. The best means of checking the ravages of the larvæ are described on page 91, but great care must be taken to apply the remedies so as not to injure the roots, and salt is best avoided. Quicklime forked into the borders 3 or 4 inches deep is inimical to grubs and not injurious to vines. The weevils are readily captured by laying white cloths under the vines in the daytime; and at night, after dark, the vines should be shaken briskly, when the weevils will be found on the cloths, and may be collected and destroyed. A good light is necessary, also a quick eye and active fingers.

Wireworms.—These, the larvæ of different species of Click Beetle, occasionally prove injurious to the roots of vines, especially young vines planted in borders, mainly composed of turfy loam. The best and safest remedy is to capture and destroy the larvæ by means of carrot and other baits (see Vol. I., page 278).

GUAVAS.

TWO species of Guava are esteemed for their fruit, both raw and in the state of jelly. The fruit has the best flavour when thoroughly ripe and ready to fall off. It may then be eaten, like strawberries, with sugar and cream, the fruit being sliced and sugared from two to eight hours before using. Guavas make splendid pies. Their chief use, however, is for jelly, which is universally acknowledged to be the finest that is made.

VARIETIES.

PEAR-SHAPED WHITE GUAVA (*Psidium pyriferum*).—

Flower white, May and June ; fruit pear-shaped, about the size of a hen's egg, very smooth ; sulphur yellow, tinged with red ; pulp flesh-coloured, sweet, aromatic, and grateful to the palate. Evergreen low tree, 10 to 20 feet. West Indies. This species requires a stove temperature.

STRAWBERRY, or CATTLE'S GUAVA (*P. Cattleyanum*).—

Flower small, white, fragrant, May ; fruit spherical, nearly round, about the size of a small walnut ; skin deep claret, resembling, but thinner than, the skin of the fig ; pulp soft, fleshy, purplish red next the skin, paler towards the middle, and quite

white in the centre ; juicy, in consistence much like a strawberry, which it resembles in flavour. Evergreen, bushy, low tree, 10 to 20 feet. Native of China, whence it has been introduced into Brazil, and is extensively grown in both countries. The bushes are heavy bearers, "and more jelly can be made from an acre of guavas than from any other kind of fruit, currants not excepted" (Wickson). The strawberry guava is the best for cultivation in this country. It succeeds in warm greenhouses and in light conservatories, is ornamental, and affords a long succession of fruit—often from September through the winter.

Propagation.—This is effected by seeds, layers, and cuttings. Seeds taken from the finest perfectly ripe fruit, sown at once in sandy soil, placed in gentle heat, and kept moist, soon produce plants, which, if potted singly when large enough, and grown in a light position, fruit in about the third year. Layers of the half-ripe young shoots, tongued or notched at a joint, placed in small pots, filled with sandy soil and kept moist, become sufficiently rooted for detaching in six to eight weeks. Layers of ripe wood require about a year to become well rooted. Cuttings of the young shoots, getting a little firm at their base, inserted in sand under a bell glass, and placed in bottom heat, root freely in a few weeks, when they should be inured to the air of the house and potted singly, keeping the plants in small pots through the winter and in plenty of light. In the spring they should be shifted into larger pots, and if well grown they will fruit in the second or third year.

Training.—The plants should be taken up with a clean straight stem, rubbing off the side growths to the height of stem required, then pinching out the growing point of the upright growth. To form dwarf bushes, take out the point at 12 inches, encourage three side shoots, and stop these at 6 inches of growth, pinching subsequent growths similarly so as to secure a sturdy, well-branched, fruitful habit. Compact bushes are then formed for growing in pots, tubs, or planting. Low-stemmed trees can be had by keeping each to one stem, and when that is as high as required allow the head to form. Standards with 3 to 4½ feet stems are excellent for planting out in winter gardens, or growing in tubs in large conservatories. Trees with heads 10 to 12 feet in height and about as much through are charming when covered with myrtle-like flowers, and useful in producing fruit.

Soil.—Sandy, fibrous loam—the top 2 inches of a pasture or sheep-walk where the substratum is a calcareous gravel or chalk, three parts; leaf soil, or dried cow manure, half a part, and charcoal nuts half a part, the turf torn or chopped up from small to rough according to the size of the plants, and the whole thoroughly incorporated, form a suitable

compost. If there is a deficiency of grit in the loam, enough sharp sand must be added to render the compost porous. The drainage must be perfect. Pots and tubs will need drainage material in proportion to their size, in every case thorough, and borders need a foot in depth of rubble, with a drain to carry off the superfluous water, and about 18 inches depth of soil.

* *Potting and Planting.*—These operations are best performed in spring, just before the plants commence growth. Young plants in pots may be given a second shift in July.

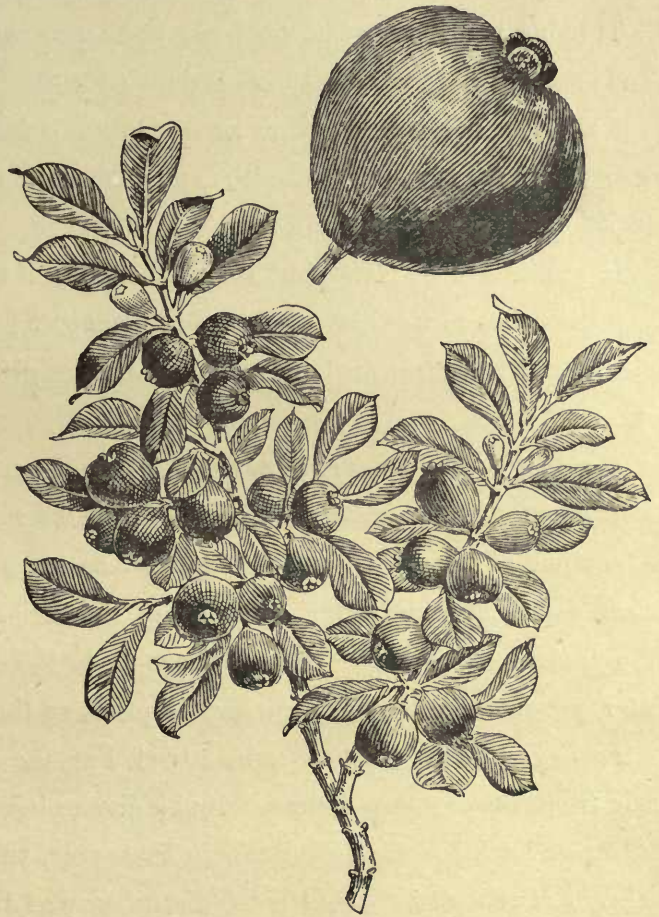


Fig. 107. SPRAY OF STRAWBERRY GUAVA IN FRUIT.

Over-potting must be avoided, pots a couple of inches more in diameter than those from which the plants are transferred being ample at each shift. When the plants come into bearing, and it is not desired to increase the size of the pots more than can be helped, potting need only be performed every second or third year, and by reducing the ball of roots so as to admit an inch of fresh soil all round, and at the bottom by cutting off the lower portion of the ball, they may be kept in the same size of pots, or a little larger, indefinitely. Pot firmly so that the fresh soil will be as compact as the old ball of roots.

Tubbing is performed in much the same manner as potting; the chief points are to provide apertures and plenty of drainage for the free escape of surplus water. Avoid large shifts. Every third year, as a rule, is often enough to re-tub the trees; but whenever a tree becomes unhealthy, no time should be lost in giving a change of soil, and it ought to have been attended to sooner.

In planting trees from pots, loosen the sides of the ball, after removing the drainage. Keep the collar rather high, and ram the compost firmly about the roots. The soil in all cases should be rather dry, and a good watering given after potting, tubbing, or planting out.

Watering.—The trees require copious supplies of water when growing, never allowing them to suffer by the want of it; yet making the soil sodden and sour speedily causes the destruction of the roots, and the foliage assumes a sickly hue. Let the soil become rather dry prior to watering, and before the foliage becomes limp afford a thorough supply, always moistening the soil through to the drainage. In winter afford sufficient water, yet no more than is necessary to preserve the foliage in health.

Feeding.—When the trees are restricted at the roots, and swelling the fruit, liquid made from cow or sheep manure may be given along with soot water occasionally, using it clear and not too strong. Trees in large pots, tubs, or planted out may have the old surface soil removed without much disturbance of the roots, and fresh loam and manure supplied in advance of growth. A sprinkling of two parts superphosphate, and one part each of nitrate of potash and sulphate of lime, mixed, is, perhaps, the best fertiliser for guavas, but it must only be applied in moderate quantities at a time.

Thinning the Fruit.—When guavas become established they are heavy bearers, and require to have the fruit thinned, or it will be small and poor—next to worthless for dessert, and very indifferent for jelly. The fruits left should have room to swell to the size of a walnut without touching each other. The pear-shaped guava requires to have the fruit at least three times further apart than that of the strawberry guava.

Pinching and Pruning.—While the heads are forming and afterwards, growths that are likely to interfere with their symmetry and equality of vigour should be pinched, and this, if properly attended to, not only secures a well-balanced tree, but short, stubby, well-ripened growths, which produce fruit abundantly. Except in young plants and an over-luxuriant growth, stopping ought not to be practised after July. Pruning is best done after the fruit is gathered, confining it to thinning out crowded, and cutting-out cross, growths; removing worn-out and irregular branches, and encouraging young in their place, keeps the trees in a healthy, fruitful state for many years.

General Management.—When the trees are in flower water must be used sparingly, and air admitted freely; water must also be kept from the fruit when it changes for ripening. At other times an occasional syringing is advantageous in cleansing the foliage; but as a rule the damping accorded to the stove or greenhouse is sufficient for affording atmospheric moisture. The strawberry guava requires a winter temperature of 45° to 50° by artificial means, and the pear-shaped guava needs a temperature of 60° to 65° in winter, both being given 10° to 15° more heat as a minimum in summer than during the winter. Strict attention must be paid to thorough cleanliness in the plants, keeping them free from dust and parasites.

LOQUAT.

THE Loquat, or Japanese Medlar (*Photonia* (*Eriobotria*) *japonica*), is an evergreen tree, with large, handsome, dark green leaves, downy beneath, and produces white fragrant flowers in pendulous racemes in November and December. The fruits are round and about the size of small apricots, pale orange in colour and slightly downy. When properly ripened they are very juicy and possess a sweet rich sub-acid flavour, quite distinct from any other fruit. Though the fruit of the loquat is seldom grown to perfection in this country there is no doubt about its excellence when well grown in a suitable climate. In both China and Japan the loquat is a common tree, and its fruit is highly esteemed by the natives of both countries. It is also cultivated in the south of France, and considerable quantities of fruit are annually secured. The fruit will bear travelling well, and finds ready purchasers in fruiterers' shops. This imported fruit, however, though attractive in appearance, is seldom of good quality, much being insipid—due probably to the circumstance of its having been gathered in an unripe state.

We have not seen any imported fruits of the loquat equal in size, colour, and quality to specimens that were grown by Mr. W. Bowell, gardener to Lady Parker, Stawell House, Richmond, Surrey, and exhibited at a meeting of the Royal Horticultural Society in 1881. They were borne in bunches, one of which, much reduced, is represented on the next page. The detached fruit, however, is full sized, or rather fair sized, for some were a little larger and others smaller. The first record we have of a tree producing fruits in England occurs in the third volume of the Horticultural Society's Transactions, published in 1822. A letter is there printed from Lord Bagot of Blythfield, Staffordshire, recounting the fruiting of a tree in one of his lordship's houses. Fruits were produced during several years, generally of very fine quality and extremely numerous, as many as twenty-one being borne on a bunch. The method adopted was to place the trees out of doors during the summer and remove them to a warm house in September, where they soon afterwards flowered, the fruit ripening early

in the following year. Lady Parker's tree was kept under glass constantly. It was grown in a pot 14 inches in diameter, and perfected a dozen bunches of fruit. We give the requisite cultural details.

Propagation.—Plants are easily raised from seed, but seedlings are a long time in coming into profit. Cuttings of side-shoots, 2 or 3 inches long, inserted in sandy soil, under a bell glass, make sturdier and more fruitful plants than those from seed; but grafting on the quince stock is the best method of securing fruitful trees. The stock should be stout and a trifle thicker than the scion. The ends of well-ripened growths make the best grafts. Grafting is best done close to the ground in late April, paring the scion very thin, and removing the leaves except those at the crown of the shoot. If the weather be hot and sunny, place a flower-pot over the graft, tilted on its northern side, and remove it in about ten days. In October the grafted trees may be taken up and potted, or planted out in a prepared bed in a conservatory.

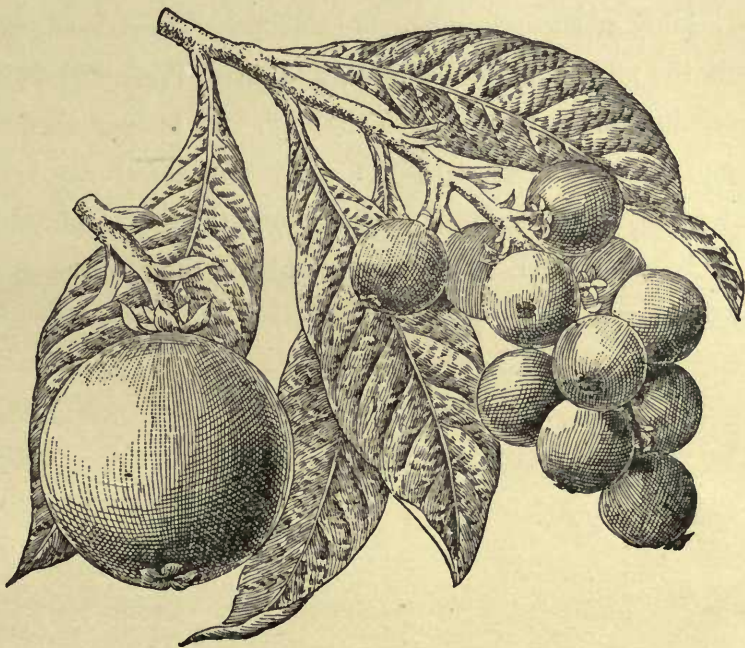


Fig. 108. FRUITING BRANCHLET OF LOQUAT.

Soil.—A mixture of light loam, the top 3 inches of a pasture four parts, old cow manure, or leaf soil and charcoal nuts half a part each, with an admixture of sand so as to render the compost porous, is suitable. The growth is too free and soft in rich soil. Perfect drainage is imperative, and a restricted root-space essential. A large tree may be grown in an 18-inch pot, grand specimens in tubs 2 feet square, and fine trees in beds 4 feet square. For the latter 18 inches depth of soil is ample, resting on 1 foot of drainage.

Mode of Bearing.—The fruit is borne at the ends of the shoots, but only on ripe wood under glass. Though trees against warm, open walls have survived ordinary winters in the south of England, yet severe frost is fatal to them. Stubby growths with plump terminal buds should be aimed at, as vigorous shoots with large leaves

flower sparsely. The plants cannot have too much light and air. A warm conservatory is suitable for them, with the sun shining right into the points of the growths.

Routine Culture.—From the commencement of growth in spring the trees should be properly but never needlessly watered, and a genial atmosphere secured. During the latter part of summer no more water should be given than is necessary to prevent the foliage becoming limp. A hot summer and rest induce fruitfulness in early autumn. Fertilise the flowers when fully expanded, maintaining a dry atmosphere, and free ventilation, with a temperature of 50° , through the winter, to perfect the fruit. When this is swelling freely liquid manure may be supplied occasionally, and a sprinkling of superphosphate is beneficial. These manurial applications are best given from the middle of February until June. Trees in pots may be placed in an orchard house in summer, where with the high day temperature, 70° to 95° , free ventilation, and comparative coolness at night, they become sturdy and fruitful, producing fragrant flowers in November or December, and the golden clusters of fruits ripen during March and April or later. They are prized for their rarity as well as for their beauty and flavour.

MEDLARS.

THE Medlar (*Mespilus germanica*) is found in a semi-wild state in some of the southern counties of England, and is indigenous in many parts of Europe and Asia. The tree is ornamental, the flowers are large and white, and the fruits are produced on the points of the shoots. Medlars are generally eaten raw, but they are sometimes made into jelly, or preserved with sugar.

VARIETIES.

DUTCH.—Fruit large, $2\frac{1}{2}$ inches in diameter, much flattened; eye very wide and open, flavour good. Tree spreading and free bearing.

NOTTINGHAM.—Fruit small, $1\frac{1}{2}$ inch in diameter, turbinate; flavour rich sub-acid; tree upright and a profuse bearer.

ROYAL.—Fruit medium, quality good; tree semi-upright and a great bearer, even when quite young.

STONELESS.—Fruit small $\frac{3}{4}$ inch in diameter, turbinate; eye small; destitute of seeds or woody core; flavour moderate; keeps well; tree semi-upright, free bearer, but not so hardy as the other varieties.

Propagation.—Seeds should be taken out as soon as the fruit is ripe and sown at once. They do not usually vegetate until the second year. The seedlings may be secured to stakes to obtain straight stems, and when large enough they may be grafted. Very few seedling medlars come true, and the greater part are inferior; a chance, however, exists of obtaining a superior variety from seed.

Budding and grafting is the general method of propagation. The pear stock is the best for grafting standard high and the quince for moist situations, though medlars grow very well on thorns. Standard trees are handsome when flowering, and worthy of being planted in pleasure grounds. Grafting is best effected in April, with scions of the previous year's growth, cutting off the extremities.

Soil, Situation, and Planting.—A good loamy soil, moist rather than dry, yet free from stagnant water, suits the medlar. Light and shallow soils are preferably mulched over the roots instead of mixing manure with the soil in great quantity. An open situation is imperative, for the medlar will not produce fruit satisfactorily when shaded by other trees or by buildings, nor when crowded in orchards or shrubberies. If sheltered from cutting winds there is no difficulty in securing fine fruit, and two or three trees usually afford sufficient fruit for most establishments. As medlars are early

bearers, the trees should be planted at half the full distance apart in the first instance, and ultimately thinned, as they grow, to not less than 18 feet apart, the Dutch variety 24 feet. Pyramids may be planted 9 to 12 feet asunder. Planting is best done in the autumn directly the leaves have fallen, but answers in early spring.

General Management.—Young trees must be properly staked, and the heads originated after the manner described for apple trees, “Low Standards,” page 26, and “Pyramids,” page 1, of the present volume. After the framework of the future tree is formed, standards require but little pruning, merely thinning out weak growths, and to prevent the branches crossing each other. Top-dressing with turfy loam and manure helps weakly trees, and those in poor and shallow soils.

Gathering and Storing the Fruit.—Medlars ought not to be gathered until November, or when fully matured, otherwise they will shrivel instead of “bletting.” Gather when dry, and spread the fruit singly, eye downwards, on a cool fruit-room shelf. If a fungus attack the stalk end of the fruit, dip it in brine. Prevention is better than cure; hence the stalk end of the fruit may be dipped in the brine, and left to dry before placing on the fruit-room shelf, as a preventive of mouldiness. Any affected fruits should be at once removed. The process of mellowing —“bletting”—usually requires a fortnight or three weeks at the least; but the time varies, and some fruits keep good for several weeks, so that a supply is had over a considerable period. Medlars for jelly must be ripe, but not quite so much “bletted” as for eating.



Fig. 109. FRUITING BRANCH OF MEDLAR.

END OF VOL. II.

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